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ABSTRACT

This broad survey of research on instructional television examines a variety of aspects relating to its effectiveness in the classroom. An introductory essay identifies significant trends that have emerged since the original publication of this report. Chapter one reviews the generalized effects of TV on pupil learning, including variations in effect caused by the age of the students and by the subject matter being taught. Chapter two outlines what has been learned about the efficient use of TV in a school system. In chapter three, thirty variables important to the effectiveness of television teaching are analyzed. Among these variables are: physical variations in the broadcast and viewing conditions; the length and timing of broadcasts; the use of humor; the teacher's role in televised instruction; and factors affecting student response to TV. Staff and student attitudes toward the use of television are considered in chapter four, while chapter five is devoted to educational television in developing nations. The effectiveness of instructional radio and other media in the learning process is also briefly considered. (SL)

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LEARNING FROM TELEVISION

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and
Wilbur Schramm

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LEARNING FROM TELEVISION:

What the Research Says

by

Godwin C. Chu and Wilbur Schramm

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Foreword

Let us make clear at the outset that we are dealing with instructional television only. A great deal of learning from non-instructional television undoubtedly occurs, but that is another story and another monograph.

This review can be described as a wide-angle view of the field with reasonably low definition. Many studies in the field have not come to our attention, and we have not been able to get access to some of those we have known about. In a number of cases, we have had to work with abstracts or summaries rather than the entire research report. For those reasons, and because we have had only about six months to work on this in order to have it available for the forthcoming Office of Education Study on Instructional Television, we have not been able to give detailed attention to studying and reinterpreting the somewhat puzzling findings in many areas. This is the next step that must be taken. Following upon this broad survey, there is need for a series of much more detailed, less hurried "state of the art" papers focused on a number of the key areas and questions which will be found in the following pages. That, and a great deal of additional research following along the roads of greatest promise and need.

Meanwhile, we hope that this review will be useful, both to the Office of Education and to the broadcasters, educators, and scholars who will also see it.

We want to express our gratitude to the ERIC clearinghouse at Stanford and its staff; to our colleagues in the Institute for Communication Research; to the scholars who have made our work easier by the syntheses and abstract studies they have made in years before – for example, Arthur Lumsdaine, of the University of Washington, Mark May, formerly of Yale, J. Christopher Reid of Purdue and Donald W. MacLennan of Brooklyn College, J. A. Harrison of London and his European committee, Charles Hoban of the University of Pennsylvania, and C. Ray Carpenter and Leslie P. Greenhill of Pennsylvania State University –; and to Mrs. Linda N. Miller, of Stanford, who typed this beautiful job in her own special manner.

Wilbur Schramm
Godwin C. Chu

Stanford, November 23, 1967

A REVIEW OF RECENT RESEARCH ON INSTRUCTIONAL TELEVISION AND RADIO

Monty C. Stanford

Introduction

This report summarizes the findings of a review* of the literature of research on instructional radio and television conducted during the past eight years to determine whether the earlier comprehensive review of research on instructional television compiled by Chu and Schramm was in need of extension or revision. The intent of the current review, therefore, is not to provide an exhaustive bibliography of research, but rather to identify any new significant trends or conclusions which have emerged since the publication of the review by Chu and Schramm.

Instructional Television

Chu and Schramm state in the Foreword to their review:

"Following upon this broad survey, there is need for a series of much more detailed, less hurried "state of the art" papers focused on a number of the key areas and questions which will be found on the following pages."

* The review was conducted by drawing upon the resources of the ERIC files as well as the literature collection of the Annenberg School of Communications at the University of Southern California. A computerized search of the ERIC files was utilized and supplemented by a manual search of recent RIE and CIJE indexes. Manual searches of the *Public Telecommunications Review* (and its predecessors) and *AV Communications Review* and of *Dissertation Abstracts International* were also conducted. During the course of these searches, several recent summaries of research on instructional radio and instructional television or related media, such as films, were discovered. This review has assumed the caveat of drawing heavily upon these summaries where appropriate. In light of the findings, perhaps this caveat will not seem so inappropriate as might otherwise be thought.

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This call has been answered, at least in part, by reviews of research on instructional radio,[1] film,[2] "Sesame Street",[3] "radiovision",[4] alternative instructional media,[5] and audiovisual media used to teach adults,[6] by ERIC/EBR Annual Review Papers,[7] and by abstract bibliographies of research on instructional television and film,[8] and educational television for preschool and kindergarten children.[9]

Although Chu and Schramm focused only on instructional television, a separate summary of generalizations from research on instructional radio is provided in this paper.

As for instructional television, two trends emerge from the progress of research conducted since Chu and Schramm issued their call: First, little has been added to either the number or precision of Chu and Schramm's generalizations. Second, what has been added is a better understanding of the total process necessary to produce effective instructional television.

The reviews mentioned above generally reiterate old conclusions. In part this is due to the fact that many research studies reiterate past studies, too often with the same failings, inadequacies, and nonsignificant results of older works; while in some areas, there is, as Campeau (1974, p.8) observes, an "appalling lack of recent, objective data." The most informative and numerous studies have been conducted on the use of instructional television in early childhood education.

Research on projects and programs like "Sesame Street," "Carrascolendas," and the Appalachia Preschool Education Program has provided a new perspective on some of Chu and Schramm's earlier conclusions. Three new gereralizations are suggested as a result of this research.

ITV 1. SUPPLEMENTARY ACTIVITIES OR RELATED ADULT INTERACTION WILL SIGNIFICANTLY INCREASE THE EFFECTIVENESS OF INSTRUCTIONAL TELEVISION FOR PRESCHOOL AND EARLY ELEMENTARY AGED CHILDREN.

Chu and Schramm (1967) and Schramm (1971) repeatedly stress the importance of considering instructional television in the "context of learning activities at the receiving end."[10] This is especially important for young children.

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[1] Forsythe, 1970

[2] Hoban, 1971

[3] Rogers, 1972

[4] Audio-tape filmstrip Foxall, 1972

[5] Jamison, Suppes, and Wells, 1973

[6] Campeau, 1974

[7] Seibert, 1972; Robertson and Yokom, 1973

[8] Reid and MacLennan, 1967

[9] Bernbaum, 1971

[10] Chu and Schramm, 1967, conclusion #4, p. 13

In research on "Sesame Street",[11] it was found that children whose mothers viewed the program and/or interacted with the children about the program viewed more and learned more from the program. In discussing the effects of viewing under motivated conditions,[12] Chu and Schramm comment that such effects may result simply from the children receiving increased instructional help from the parents. But, they also observe, parental interest may provide increased motivation to learn, more than providing increased instruction itself. Similar conclusions can probably be drawn about the use of a "Home Visitor" in the Appalachia Preschool Education Program,[13] which generally resulted in greater gains than the use of television only.

In evaluations of "Carrascolendas," a Spanish-English instructional television program, the effects of related classroom activities have been investigated.[14] "Carrascolendas" was designed to supplement bilingual class room programs in grades kindergarten-second. Here the research revealed that supplementary activities generally enhanced learning. However, there appeared to be complex relationships among contextual variables (such as the supplementary activities), language variables (including the language of testing and activities), and program production variables.

The pattern seems to be that supplemental interaction of an adult with the young viewer may be most helpful in increasing the motivation to learn. But, when that interaction is itself intended to carry part of the burden of instruction, then care must be exercised to insure that the supplemental interaction does not contradict or interfere with the televised instruction.

Since "Sesame Street" research has been heavily drawn upon in forming this conclusion, it should be noted that this research as well as the program itself has been criticized on many counts.[15] Much of this criticism has been flawed by false premises, weak methodology in research studies, or both. Sprigle (1971, 1972), for example, claimed that "Sesame Street" was not an effective substitute for personal interaction with an adult teacher. Palmer (1973) delineated the methodological weaknesses in Sprigle's research, but, more importantly, both Palmer and Lesser have emphasized that adult interaction has always been considered a necessary part of the total learning context. Instructional television, even "Sesame Street," is not a complete instructional system in and of itself. But television can be used effectively in early childhood education, and this use of television can be improved by combining it with adult interaction.

ITV 2. FOR PRESCHOOL AND EARLY ELEMENTARY AGED CHILDREN, THE USE OF CERTAIN PRODUCTION TECHNIQUES APPEARS TO ENHANCE LEARNING SIGNIFICANTLY.

Chu and Schramm concluded that there was no consistent evidence that any one of several production techniques enhanced learning. The techniques specifically mentioned include humor and animation,[16] dramatization,[17] and inserting questions.[18]

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[11] Ball and Bogatz, 1970; Bogatz and Ball, 1971
[12] Conclusion #29, p. 48
[13] Hines, 1971a, 1971b
[14] Williams, McRae, and Van Wart, 1972; Stanford, 1973
[15] Lesser, 1974; Rogers, 1972
[16] Conclusion #12, p. 28
[17] Conclusion #14, p. 30
[18] Conclusion #15, p. 31

While the generalizability of the findings may be questioned, extensive formative research on "Sesame Street"[19] revealed that certain production techniques do enhance learning for young children. In connection with the "Carrascolendas" program series, Korman (1974) conducted a detailed analysis of the cost-effectiveness of production techniques. Korman found that animation and puppets did not appear to be as effective as indicated in the "Sesame Street" research but he noted that this may have been due to the fact that "Sesame Street" used professional puppeteers and animators.

Consistent findings across both programs were that effective program segments involved songs, humor, riddles, games, or brief dramatizations.

ITV 3. FORMATIVE RESEARCH CAN SIGNIFICANTLY ENHANCE THE EFFECTIVENESS OF INSTRUCTIONAL TELEVISION.

In their conclusion number 31 (p. 50), Chu and Schramm discuss testing and revision of instructional television programs. They suggest that such a procedure may help to substitute for the lack of live feedback from students to teacher. In a convential classroom the teacher may adjust the presentation of instruction, depending on the type of verbal and nonverbal feedback provided by the students. The television teacher, who rarely has such immediate feedback, could profit from a cycle of production, viewing by a pilot group of students, and revision according to the feedback obtained from the pilot students. Such testing and revision was seldom carried out on a sustained and regular basis, however, prior to the advent of "Sesame Street."

At the Children's Television Workshop (CTW), where "Sesame Street" was produced, formative research was considered an essential and integral part of the production process. Formative research included not only tests or whole programs in the series, but also tests of program segments, production techniques, and research methods themselves.[20] The director of research for the Workshop, Dr. Edward L. Palmer,[21] stated that "Sesame Street" was:

> "an experiment in public broadcasting, preschool instruction, film and television production, formative research and evaluation, and the use of professional audience building techniques. One unusual facet of the experiment is the close working relationship betweem research and production."

This "unusual" integration of research and production has clearly been a successful experiment. While it is obvious that such procedures had been used before, primarily in commercial broadcasting, CTW firmly established the utility of formative research in the production of instruction television programming. Fortunately, the use of formative research and other "professional techniques" has not been restricted to CTW productions. Many institutions and organizations concerned with instructional television, especially in post-secondary and continuing education, have proven the value of formative research.[22]

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[19] Reeves, 1970

[20] 1969, p. 44 Reeves, 1970

[21] 1969, p. 44

Instructional Radio

Chu and Schramm (1967) list three conclusions in their survey that are generally cited as being relevant to considerations of the effectiveness of instructional radio:

> "53. Given favorable conditions, pupils can learn from any instructional media that are now available.
> "58. The use of visual images will improve learning of manual tasks, as well as other learning where visual images can facilitate the association process. Otherwise, visual images may cause distraction and interfere with learning.
> "60. Student response is effectively controlled by programmed methods, regardless of the instructional medium."

In the review of literature conducted for this update, no reports of research were found to change substantially any of the above conclusions. It was found, futhermore, that the review of research delineated in a position paper by Forsythe (1970) contains most of the relevant findings accumulated to date.

To facilitate consideration of research relevant to instructional radio, the following list of conclusions is presented in the same format as that used by Chu and Schramm. Studies cited in this list include those cited by Forsythe as well as a few others which have more indirect but pertinent implications for instructional radio in the United States.

IR 1. GIVEN FAVORABLE CONDITIONS, PUPILS CAN LEARN EFFECTIVELY FROM INSTRUCTIONAL RADIO.

Although this statement is similar to that of Chu and Schramm, unfortunately little can be said about precisely what the "favorable conditions" are. Forsythe cites twelve relevant studies[23] of U.S. research, including three cited by Chu and Schramm, plus three studies of research in India and Japan, also cited by Chu and Schramm. All of these studies were conducted more than fifteen years ago and are disparate in rigor, program topics, and the level of the communication environment which existed at the time and place of the studies. Nevertheless, the consistency of the results favors the conclusion.

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[22] Cavert, 1974

[23] Barrow and Westley, 1959; Brewer, 1939; Carpenter, 1934; Cohen, 1937; Cook and Nemzek, 1939; Ewbank, 1930; Harrison, 1932; Heron and Ziebarth, 1947; Mather and Neurath, 1959 (India); Miles, 1940; Nelson, 1957; NHK, 1955, 1956 (Japan); Wiles, 1940; Wisconsin Research Project, 1942.

It may be noted that more recent research in other countries is consistent with the results of earlier research in the United States and abroad. As Schramm (1970) points out, studies such as these indicate that radio can be used effectively in developing nations (and may be the most cost-effective medium), but the generality of study results is subject to question. (For example, Jain, 1969; Sitaram, 1969; Sotelo, 1973; Spain, 1973.)

IR 2. INSTRUCTIONAL RADIO IS PROBABLY MORE EFFECTIVE THAN OTHER NONAURAL MEDIA FOR INSTRUCTION OF CERTAIN TOPICS, PARTICULARLY MUSIC AND FOREIGN LANGUAGES.

The Wisconsin Research Project (1942) found results that favored radio students in courses on the fundamentals of music and Harrison (1932) also found radio to be effective in teaching music appreciation. Studies of radio instruction in other countries, including the NHK (1946) study cited by Forsythe and by Chu and Schramm, do not contradict this tentative assertion, although one may question the cross-cultural generality of such findings for students in the United States.

As for language instruction, a study by Cook (1964) indicates not only the potential effectiveness of radio but also the potential of radio for innovative instruction. Chu and Schramm (p. 86) succinctly comment on this study:

"A rather interesting innovation in the use of radio for language teaching was reported by Cook (1964). College students in elementary Spanish served as subjects. The experimental group students were each provided with a pocket radio, which was equipped to receive broadcasts of 303 Spanish drill exercises and a limited amount of text material programmed in a stimulus-response pattern. The control group had only the classroom instruction. Midway through the semester, the control group students were also given radios because they felt themselves to be at an unfair disadvantage.

"The data indicated that the experimental group students had about 11 times as much drill as the control group students. The experimental group scored significantly higher in most tests before the control group acquired radios, but after that, the differences between the two groups gradually disappeared. After they received radios, the control group students showed a significant increase on stimulus-response test scores."

Again the results of research in other countries, where English is often the foreign language being taught (such as NHK, 1955) also favor the conclusion.

IR 3. THERE IS NO APPARENT DIFFERENCE IN INSTRUCTIONAL RADIO AS AN AURAL MEDIUM AS COMPARED TO PRINT MEDIA IN EFFECTING ATTITUDE CHANGE.

In a study of radio used for science instruction, Brewer (1939) found that elementary school radio students showed more favorable attitudes toward science than control group students. However, Lanman and Henderson (1953) found no significant differences in attitude change effected by radio as compared with silent reading.

Other studies of attitude change effected by aural and print media tend to indicate no significant differences.[24] These studies again are disparate and were conducted twenty to forty years ago. The findings are, however, at least generally consistent.

IR 4. IN DEVELOPING NATIONS, THE MOST FREQUENT APPARENTLY SUCCESSFUL USE OF INSTRUCTIONAL RADIO IS IN CONJUNCTION WITH OTHER MEDIA OR INTERPERSONAL COMMUNICATION CAMPAIGNS.

This conclusion may seem so broad (and, to some, so obvious) as to be not worth mentioning. It is listed to draw attention to a recurring conclusion found in broad reviews such as Chu and Schramm (1967), Jamison, Suppes, and Wells (1973), and Rogers and Shoemaker (1971). Virtually any use of an instructional device, medium or technology is enhanced by careful attention to the total instructional system. Rarely is any medium used in isolation to carry the entire burden of instruction. In a quite recent comprehensive review of instructional radio in developing nations, McAnany (1973) concludes that the "context" in which radio operates is of fundamental importance. Schramm (1971) points out the methodological problems of research on instructional media, when he describes the tradeoffs of scientific reproducibility and practical realism involved in studying the media in the context of the instructional system.

Conclusions

The most obvious conclusion of this review is that the work of Chu and Schramm (1967) essentially constitutes a definitive treatment of research on instructional television and radio. Some refinements have been suggested by this review, but they are indeed sparse.

The most significant conclusion that has emerged from this review affects policy considerations of the management of media production rather than the variables of production techniques. Ranging from work at the Children's Television Workshop to the recent ventures of many institutions and organizations into "open learning" (Cavert, 1974), a pattern of market analysis, formative research, and production cycles has been shown to be most successful.

The Janus-like quality of this trend, however, must also be considered. Formative research does not usually lead to strong, meaningful advances in the body of scientific knowledge about instructional media. This problem is expertly described by Schramm (1971) as a matter of tradeoffs at some level between the requirements of experimental research which contributes to generalizable knowledge and the requirements of specific program research which answers immediate, localized production questions.

The conclusions of Chu and Schramm, as well as those presented in this paper, are "mid-level" conslusions. They are conclusions or generalizations which generally begin with the assumption "all other things being equal." Certainly, this review of research has reinforced the constant reminder from Schramm and others that "all other things" are almost never equal in education. Formative research conducted in connection with a specific program production for a specific audience also begins with constants, i.e., assumptions of "all other things being equal." But reliance on formative, program specific research and on scattered, independent studies will probably continue to lead to mid-level conclusions generated at the rate of a few per decade.

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[24] Cherrington and Miller, 1933; Haugh, 1952; Knower, 1935, 1936; Rulon, 1943, 1944; Utterback and Harding, 1955; Wilke, 1934.

A "tried-and-proven" model of successful product program research is now available. It would be most encouraging if an equally successful model of basic research were available to guide the search for more powerful and more generalizable conclusions. Such a model would account for the complex multivariate system of learning of which instructional television and radio are a part and would enable more effective and more cost-effective program production and policy making at all levels, from local to national education.

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I. Do Pupils Learn from Television?

1. GIVEN FAVORABLE CONDITIONS, CHILDREN LEARN EFFICIENTLY FROM INSTRUCTIONAL TELEVISION.

There can no longer be any real doubt that children and adults learn a great amount from instructional television, just as they do from any other experience that can be made to seem relevant to them – experiences as different as watching someone rotate a hula hoop or reading the encyclopedia. The effectiveness of television has now been demonstrated in well over 100 experiments, and several hundred separate comparisons, performed in many parts of the world, in developing as well as industralized countries, at every level from preschool through adult education, and with a great variety of subject matter and method.

Much of this report will be concerned with what we know about the nature of "favorable conditions" for learning from television, and, in particular, what conditions are more favorable than others. Here we must say something, however, about what has been done to measure the "efficiency" of learning from television.

In general, this has been measured either by comparison with conventional instruction, or by comparison with some absolute or assumed standard.

Television instruction has frequently been compared with *no* instruction. In other words, does the student learn at all from television? A surprisingly large number of experiments have been done this way. For example, Sykes (1964) compared 58 education majors who had been randomly assigned either to a television group or a control group. The former group watched six 45-minute art lessons over six weeks, while the latter did not. A posttest showed, as might be expected, a significant difference in favor of the television group.

Another approach to measurement is for the teachers or experimenters to set a standard of satisfactory performance. For example, Roy, Schein, and Frisina (1964) tried out on 68 deaf students a television program teaching typewriting. The majority of children were able to achieve the criterion level of speed and accuracy in what seemed to the experimenter "a relatively short time." In another experiment, Frazier and Evans (1960) had 151 teachers and 4,814 third- and fourth-grade children in Ohio watch ten half-hour television programs on elementary science. After the programs, the teachers reported that they themselves had significantly greater confidence in teaching elementary science and that the pupils showed more interest in it. (Unfortunately, a test of achievement showed no significant increase in the children's scores.)

A more widely useful standard of comparison can be derived from performance on standardized tests. For example, after television had been installed in the Washington County School System, Hagerstown, Maryland, the performance of students was measured on the Iowa tests of achievement. These tests are given each year to hundreds of thousands of school children throughout the country, and thus standards are established by which test scores in any one location can be compared with national averages. Thus, if Hagerstown children in grade 5 gained 1.9 years, measured against national norms, in 1.0 years of televised instruction – as they did – this is rather impressive evidence of efficient learning from television. If the average level of Hagerstown junior high mathematics students rose, during four years of televised instruction, from the 31st to the 84th percentile, measured against national norms – as it did – then, again, this can be assumed to be efficient learning.

Hagerstown has been working with instructional television so long, and has adopted television so fully into its instructional patterns, that it may be interesting here to summarize the results of its measurements against national norms. This summary is by Wade (1967):

1. Throughout the classes studying arithmetic by television, substantial gains in performance were made in the first year of televised instruction, and later classes in the same grades maintained or improved on these gains. Some of the changes were spectacular. For example, in grade 5 arithmetic the pupils gained an average of 1.9 years in knowledge of arithmetical concepts (as measured on the Iowa test of basic skills) in one school year. The order of the gains throughout the first years of television may be illustrated by the scores made by rural students shown in Table 4.

TABLE 4. Effects of televised learning

	Grade 3	Grade 4	Grade 5	Grade 6
National norm in May	3.90	4.90	5.90	6.90
1958 (before television)	3.59	4.43	5.26	6.49
1959 (first year of television)	4.06	4.97	5.77	6.83
1960	4.18	5.01	6.13	7.17
1961	4.30	5.08	6.19	7.28

Thus these rural students, averaging half a grade below the national norm before television, all came to exceed the norm: grades 3 and 4 after one year of television, the others after two years.

2. After three years of television, achievement in rural schools (where students had originally averaged one-quarter to one-half a grade below urban students) increased to a point where achievement was comparable with that in urban schools. This suggests that television's ability to share the best teaching may have had an effect.

3. The same pupils who were making such striking gains in arithmetic, which was taught by television as a regular part of the course, made very small gains in reading, which was offered by television on a voluntary basis and unsystematically.

4. In junior-high general mathematics, the average achievement level of urban pupils on a standardized test of concepts rose in four years of television instruction from the 31st percentile to the 84th percentile, and on a standardized test of problem-solving from the 33rd to the 68th percentile. Rural schools on the same tests rose from the 14th to the 38th percentile on concepts, but made very slight over-all gains in problem-solving.

5. In grade 10 mathematics, urban schools rose from the 34th percentile before television to the 51st. Rural schools, for some reason, declined somewhat in the same period.

6. In grade 6 science, television pupils showed more growth than conventionally taught pupils at all ability levels, as Table 5 shows:

TABLE 5. Comparison of growth with pupils taught conventionally and by television

Ability level (grade 6 science)	Taught conventionally		Taught by television	
	Av. I.Q. 1	Achievement growth	Av. I.Q.[1]	Achievement growth
111-140	117	12 mos.	118	15 mos.
90-110	100	11 mos.	100	14 mos.
57-89	83	6 mos.	83	13 mos.

[1] Intelligence quotient

7. Grade 8 general science achievement, as measured on a standardized test, was two years higher, after several years of television, than before television. Such was the case both in Hagerstown schools and rural schools.

8. Small gains were recorded in the core course – social studies and language.

9. Significant gains were recorded when United States history was taught by television. The following figures show the gains made in the outlying schools that received television later than did Hagerstown (the percentile on national norms in 1958 before television was 28): in 1959 (first-year television), 45; in 1960, 46; in 1961, 50.

10. Consistent, though not spectacular, gains were recorded in grade 12 English taught by television.

11. Although it is somewhat more difficult to assess achievement in music and art, on such tests as Hagerstown was able to give in these fields, pupils who had been exposed to the televised courses in these fields scored higher than pupils who had not had the television instruction.

At the end of this chapter a number of examples will be given of research of this general kind. Let us now turn to the kind of efficiency test which has been most commonly used with instructional television: comparison with conventional instruction.

It will be obvious that this is an extremely difficult kind of experiment to design and conduct satisfactorily, because of the problems that arise in controlling the variables so that one knows the comparison is truly measuring clear and defined alternatives. For example, what do we mean by "conventional" instruction? Supposedly, face-to-face instruction in a classroom. But can a finding concerning conventional instruction in one classroom be generalized to conventional instruction in other classrooms? Certainly not unless we know exactly what went on in that classroom, and find its essential characteristics duplicated elsewhere – if we can identify the essential characteristics. Furthermore, what are we really comparing when we measure the result of television teaching as against classroom teaching? Is it television against face-to-face, or teacher against teacher, or some interaction?

And what about the subjects of the experiment? Ideally, we ought to use the same children and compare what they learn from the two methods, but this is unrealistic. We can match them for I.Q. or pretest or previous grades, or some other bench mark, but then we are never sure that we are matching them, even if it were possible, in such a way as to make them really equivalent.

The best way is probably to assign them at random to different treatment groups, but this makes it difficult for schools to cooperate in the experiment. And even if the schools are willing to cooperate, arbitrarily pulling out children from their original classes and randomly assigning them to different groups might create a feeling among the children that they are being used for guinea pigs. If so, the results of testing would hardly be generalizable because of the reactive nature of the experimental procedures.

Experimental design has ways of meeting these difficulties in case random assignment is not feasible. One is the method of covariance analysis, which we find in many of the experiments comparing television teaching and face-to-face teaching. Intact groups are used, the I.Q. or some pretest scores are obtained, and then the posttest results of the experimental and control groups are compared after their differences in I.Q. or pretest scores have been taken into account. This method, however, has its limitations: Because of measurement imperfection, we may not be able to take into account the initial differences between the two groups as fully as we wish to. Besides, since we are using intact groups, there is always the problem of other kinds of group idiosyncrasies which are relevant to the posttest results, but which are not taken care of by the covariance analysis. This problem of intra-session history is of course general to all experiments, but it is particularly apt to cause trouble in educational research where there is often no alternative except the use of intact classes.

Then there is the problem of making the stimulus comparable in the two groups. Obviously, if different teachers are used, as is often the case, then we don't know whether we are comparing the two methods of instruction, or the two teachers. Even if the same teacher gives both the face-to-face instruction and the telecast lecture, we still cannot be sure that the contents of the instruction will be exactly the same unless the face-to-face lecture is telecast to the experimental group at the same time.

And even the telecasting of a face-to-face lecture to the experimental group does not work as well as it may sound. Imagine a group of children sitting in a studio with all the lights and equipment and camera activities. The learning situations of the studio group and the TV group obviously contain many differences other than the method of instruction, which is what we are interested in. In fact, in one experiment reported by Williams, Paul, and Ogilvie (1957), students receiving a lecture in anthropology in the studio did significantly less well not only than the group that saw the telecast lecture, but also the group that only heard the same lecture over the radio, apparently because of the environmental distractions in the studio.

Therefore, test results from the TV group and the face-to-face groups would, strictly speaking, be comparable only if the students are assigned randomly and in such a way as to minimize the reactivity of the experimental arrangements, if the qualities and performance of the teachers are in every way the same, if the contents of the lectures are the same, and if the learning environments are the same. Only then can we be reasonably sure that we are comparing the effect of presenting a lecture on television with the effect of presenting the same lecture face-to-face.

These are big ifs. It should not be surprising that only a tiny portion of all the comparisons of instructional television with conventional teaching have been done in a way approximating this clean experimental design. For instance, Stickell (1963) found, out of some 250 comparisons, only 10 that meet his rather rigid requirements for adequate experimental design. He discovered 23 studies that were "partially interpretable." All the 10 that were "interpretable" showed "no significant difference" in learning, at the commonly accepted level of significance, between televised teaching and conventional teaching.

Here we are faced with the problem of how to treat the great majority of the less rigidly designed experiments. Shall we simply term these experiments as "uninterpretable," as Stickell did? Or shall we use them for what they are, namely, research findings that do not strictly meet the requirements of methodological rigor but nevertheless may provide some information on a pertinent research problem?

We are inclined to take the second approach, for a number of reasons. First, even though most of these studies methodologically are not up to rigid standards of clean experimentation, the shortcomings are most likely the results of practical limitations and realistic conditions. In other words, this is what a school can do under the circumstances. Secondly, even though each individual study is "uninterpretable" because of certain unknown or unspelled out situations which were particular to that study, it is quite unlikely that the particular situations surrounding all these studies would be biased in the same directions. Here we have a situation involving hundreds of experiments independently conducted under a wide variety of conditions. This is analogous to sampling several hundred individuals having a wide variety of backgrounds. Under the law of random operation, it will not be unreasonable to assume that in these several hundred experiments, the effects of the unknown particular situations which might have rendered each individual study "uninterpretable" would on the whole cancel each other out. In this sense, we might be justified in looking at the general picture that has emerged from these majority of experiments, to see whether this general picture agrees with what we already know from a few clean, rigid experiments. If we do find agreement, we will have an additional assurance about the comparative effectiveness of televised teaching and face-to-face teaching.

When we look at the majority of the less rigidly designed experiments, the general finding is the same as that from the rigidly designed experiments, namely, no significant difference between learning from televised teaching and learning from conventional teaching. Let us give a few examples.

Schramm (1962) summed up 393 experimental comparisons on television vs. classroom teaching, including a considerable amount of unpublished material. He reported that 255 of these comparisons showed no significant differences, 83 were significantly in favor of televised teaching, and 55 significantly in favor of conventional teaching.

Summarizing the results of a three-year national program in which 200,000 students from 800 public schools took part, Pflieger and Kelly (1961) reported that whereas most comparisons showed no significant differences, 119 were significant in favor of TV-taught students, and 44 in favor of conventionally taught students.

Kelley (1964) made more than three hundred matched achievement test comparisons between television teaching and conventional teaching during the period of 1956-1961. These test comparisons were classified under four subject matter areas: English, mathematics, science, and social studies. Results of his comparisons showed that students generally did well when television was used as a regular resource. In one out of every four comparisons, significantly higher achievement scores were made by television groups.

We have recently reviewed, up to 1966, 207 published studies in which television teaching has been compared with conventional teaching. Of the 421 separate comparisons made in these studies, 308 showed no significant differences, 63 showed television instruction to be superior, and 50 found conventional instruction better.

Therefore, all these summaries show that in the great majority of comparative studies, there is no significant difference between learning from television and learning from conventional teaching; and that where there is a significant difference, it is a bit more likely to be in favor of television than of conventional instruction.

Bearing in mind the caution we must take in interpreting this information, what does it mean to educators, to teachers, and to school administrators? Here we have hundreds of comparisons, usually involving on the one hand the best a system can put together in teachers, visual resources, and careful preparation, all presented on the television screen, and on the other hand, often ordinary classroom practice, ordinary teachers, and ordinary teaching aids. And yet the predominant finding is no significant difference. It can be argued that if this is the case, why introduce instructional television?

But this is precisely the point: Instructional television does make it possible to share teaching more widely. It can share the best teaching as well as ordinary teaching. It does make it possible to give teachers more time to prepare, and make more resources for teaching. If new ventures are to be undertaken in education, if courses or materials not now available in existing classrooms can be offered there by television, or if television can be used to extend the benefits of education to children or adults not presently served by existing schools – then it would appear that television can be used for such purposes with considerable confidence.

Furthermore, the research seems to suggest that there are a number of cases in which televised instruction has brought about *more* learning than the existing level of classroom teaching. The number of these cases seems to be greater than chance. Now, if we can identify the qualities of television teaching that make for maximum learning, perhaps schools can hope to use televised instruction more effectively even in existing classrooms.

Finally, it should be understood that many of the comparisons of television with conventional instruction are of classes taught *completely* by television vs. classes taught completely by conventional methods. As we shall see later in this book, this is an unreal comparison, because almost nowhere in the world is television being used in classrooms without being built into a learning context managed by the classroom teacher. Indeed, some of the most successful uses seem to depend on the studio teacher and the classroom teacher working as a team, toward the same learning goals. Therefore, the finding of "no significant differences" seems to mean that television can do its part in this combination, and one goal of future research and practice is to find what *combinations* will be more efficient than *either* classroom teaching or television teaching alone

2. BY AND LARGE, INSTRUCTIONAL TELEVISION CAN MORE EASILY BE USED EFFECTIVELY FOR PRIMARY AND SECONDARY SCHOOL STUDENTS THAN FOR COLLEGE STUDENTS.

We have seen that instructional television can be as effective as conventional teaching, but does this finding hold for all grades of students? Might there be a difference between primary and secondary school students and college students?

In the study by Schramm (1962) cited before, he found a tendency from 393 comparisons indicating that the lower the grades, the more likely television teaching will be superior to face-to-face teaching where differences do occur. At the third to sixth grade level, he found 50 comparisons in favor of TV, 86 no differences, and 16 in favor of face-to-face teaching. The same picture held for seventh to ninth grades: 18 in favor of television, 28 no differences, and 5 in favor of face-to-face teaching. For tenth to twelfth grades, the trend was reversed: 12 in favor of television, 57 no difference, and 21 in favor of face-to-face teaching. At the college level, the reverse trend became even more pronounced: only 3 in favor of television, 84 no differences, and 13 in favor of face-to-face teaching.

In our review of the 207 studies involving 421 separate comparisons, we have come up with essentially the same findings. Out of 202 comparisons made at the college level (Table 1), we found 28 (14%) in favor of conventional instruction, and 22 (11%) in favor of television instruction. This gives conventional instruction a slight net advantage of 3%. Of the 64 comparisons at the elementary school level, only 4 (6%) were in favor of conventional instruction, while 10 (16%) were in favor of television instruction. Similarly, of the 122 comparisons made at the secondary school level, 16 (13%) were in favor of face-to-face teaching, and 24 (20%) were in favor of televised teaching. At the elementary and secondary levels, television instruction has a net advantage of 10% and 7% respectively.

Table 1

Results of 421 Comparisons between Instructional Television and Conventional Teaching

	No significant differences	Television more effective	Conventional more effective
Elementary	50	10	4
Secondary	82	24	16
College	152	22	28
Adults	24	7	2
	308	63	50

Although a statistical test for the significance of such differences would not be appropriate in this case, these findings consistently indicate that television instruction is apt to be more effective in teaching primary and secondary school students than college students.

In the absence of more evidence, we can only speculate as to why this may be so. One possible reason could be the lack of immediate feedback in televised teaching. We might assume that the higher the grade level, the more complex the material taught, the more serious will be the lack of immediate feedback and discussion. The problem of feedback will be more fully discussed later.

Another possible factor is the role of television in the environment in which the students are brought up. We might assume that the younger the children, the more intimately has television been part of their experience of growing, and the more readily they will be able to learn from this medium.

A third possibility is the different preferences for the media by different age groups. For instance, Ames (1958) got the impression after his visits to instructional television in ten big cities that the TV teacher usually has a special prestige value for younger pupils, and thus may be able to stimulate and motivate learning. Perhaps the younger pupils are more likely to prefer television teaching while the older students are more likely to prefer face-to-face teaching.

Finally, we must consider the attitude of the teacher. Any school administrator knows that the classroom teacher can have either a facilitating or a hindering effect on learning aids brought into the classroom. Undoubtedly the secondary school and college teacher is apt to be more defensive about sharing his classroom with a televised teacher from outside, and less willing to surrender his right to conduct the lecture and demonstration parts of a course. The elementary school teacher is accustomed to a more flexible schedule, less accustomed to lecturing, and more likely to be grateful for outside help with unfamiliar subject matter (like foreign language or the new math) or with demonstrations or visual aids which could hardly be produced in a single classroom. Therefore, if the elementary schoolteacher is more receptive than the secondary or the college teacher to televised instruction, we might expect that the students too would be more receptive. We shall summarize some of the studies of teacher attitudes toward television later in this volume.

3. SO FAR AS WE CAN TELL FROM PRESENT EVIDENCE, TELEVISION CAN BE USED EFFICIENTLY TO TEACH ANY SUBJECT MATTER WHERE ONE-WAY COMMUNICATION WILL CONTRIBUTE TO LEARNING.

Perhaps even this statement is unduly restrictive. In a number of cases, instructional television has been built into a two-way system, either by means of swift feedback through telephones or push-buttons in the classroom, or slow feedback through correspondence study as in Japan where the combination of television and correspondence study has proved to be a powerful learning tool.

Intuitively, it would seem that television would not commend itself for use in teaching where most of the work consists of student practice (for example, a course in public speaking or typewriting) or where the essential part of the learning experience grows out of discussion between student and teacher or among students (for example, a seminar). But the basic speech course has been taught for a number of years by the Chicago Junior College entirely by television except for two or three meetings on campus during the year, and the television students have done on the average at least as well as campus students taught conventionally. In a number of instances, television has been used as an essential part of a speech course. Examples are Reid's experiment (1960) at the University of Missouri; Clevenger and Cobin (1959) at the University of Illinois; and Ivey and De Marco (1961) in the Arkansas public schools. In each of these, the performance of students taught in part by television was as good as, or better than, that of students taught conventionally, and there was some evidence of more favorable attitudes developing toward the course.

Typewriting? Pasewark (1957) compared the teaching of a beginning course in typewriting by television and by conventional methods. The television-taught students learned to type significantly faster and somewhat more accurately.

Discussion? Becker, Dunlap, and Gerber (1957) tried an experiment at the University of Iowa in which part of a class discussed in the studio with the instructor while the rest of the class watched. There were no differences in final performance between the group thus taught in part by television, and a group taught conventionally, although the students who had to *watch* the discussion were less favorable to the course. And of course television has been used in a number of cases to "feed" discussion groups – the group has its own leader, but discussion takes off from a keynote talk or demonstration delivered by television. This is the principle of the Indian radio rural forum, which has long ago proved its effectiveness; television is at least as effective as radio when used in that way, as experiences in France and Japan have shown.

Laboratory study, in which a student works individually but requires frequent access to an instructor, might seem to be a kind of subject ill-adapted to television. But Seibert and Honig (1960) and Diamond (1962) both conducted laboratory sections by television (in chemistry and anatomy, respectively). Diamond found no significant differences between groups taught conventionally and by television, and Seibert and Honig found only one difference in six comparisons – this in favor of the television group. Diamond found that television saved time by permitting an entire class to see a demonstration at the same time.

An amazing variety of subject matter has been taught by television, in most cases with "no significant differences" from standard results or conventional teaching. The catalogue extends from literacy training (to which television has now contributed successfully in Italy, the Ivory Coast, Peru, and the United States); driver education (taught effectively by television in Cincinnati public schools, to take an example); dentistry (where effective use has been made of television both in student training and in extension courses – for example, Tannenbaum, 1956; and Grant, Blancheri, Lorencki, and Merrill, 1963); "guidance" (in Portland, Maine, sixth-grade classes presented guidance information by television are reported to have done at least as well in information and adjustment scores as classes to whom the information was given face-to-face – see Lemke, 1963); agricultural extension (summarized by Crile, 1957); IBM customer engineering training (television raised trainee's grades over former years – see Beatts, 1957); even to the task of orienting preschool children to the experiences they would have in the first grade (Durost, 1961).

In at least three school systems, an entire curriculum is taught by television. These are Hagerstown, Maryland; American Samoa; and Chicago. In the first two of these, television is used to teach the core of every course from first grade through twelfth; in Chicago, a two-year junior college curriculum is offered by open-circuit television.

In the 393 comparisons summarized by Schramm (1962) the results by subject areas were as follows:

Subject	Number of comparisons	Percentage in which TV groups did as well as or better than control groups
Mathematics	74	86.5
Science	84	90.5
Social studies	74	93.2
Humanities	53	77.4
Languages	84	82.1
Health, safety	24	79.2

From the 421 comparisons we have made, the results by subject areas are as follows:

Subject	Number of comparisons	Percentage in which TV groups did as well as or better than conventional groups
Mathematics	56	89.2
Science	100	86.0
Social studies	77	89.6.
Humanities	45	95.5
Languages	77	88.3
Skills	26	96.1
Miscellaneous	40	75.0

While the previous comparisons made by Schramm indicated that instructional television had, on the average, somewhat less success with humanities than, for instance, with natural science, the more recent comparisons we have made suggest just the opposite. The overall impression one gets from the two summaries of comparisons seems to be: So far as we can tell from available research evidence, there is no general area where television cannot be used efficiently to teach the students.

However, this does not mean that instruction can be turned over entirely to television in any of these subject-matter areas. As we shall have occasion to point out later, almost nowhere in the world is television now being used seriously to carry the *entire* weight of teaching; it is always combined with classroom teaching, or supervised learning groups, or some other device to stimulate and direct learning at the receiving end. What the results do seem to mean is that television is not essentially subject-bound. It can contribute in many areas. Where demonstrations are needed or where expert teaching needs to be shared widely, it is strong. Where learning requires continuing interchange between student and teacher, it is not strong.But in almost any area of subject matter, if needed and if used well, it can contribute.

* * *

Examples of research comparing TV instruction with no instruction:

Enders (1960) compared two groups of sixth-grade children who had received a series of science programs on television with a control group that did not watch the programs. Both television groups scored significantly greater improvement than the control group.

Lottes (1961) randomly assigned 213 primary schoolteachers to two treatment groups. The experimental group viewed 15 half-hour programs on reading instruction. The control group was told to write weekly reports on reading instruction so that any Hawthorne effects could be assessed. The TV group teachers showed a significant increase in classroom performance, while the control group had no improvement.

In an experiment conducted in an interracial neighborhood in New York City, Langdale (1962) found closed-circuit television an effective medium for teaching English to Spanish-speaking people, and Spanish to English-speaking people.

Castle (1963) reported on a study in which a postgraduate medical program was presented on open-circuit educational television. Pretest and posttest results were obtained from 18 physicians and 31 medical students who had viewed the program. The average per cent of correct answers rose from 70 in the pretest to 88 in the posttest for the physicians, and from 64 to 85 for the medical students.

Hennes and Saltzman (1965) presented to 570 gifted children in fifth and sixth grades three series of enrichment units on astronomy, mathematics, and geography through television. The work was on a voluntary basis, and there was no classroom follow-up. Tests showed that children who viewed the enrichment lessons scored significantly higher than a control group of 1,000 children.

In England, Belson (1956) found that a television program on BBC produced an increase in viewers' knowledge of French words and phrases and general information about France.

Ogawa (1960) let 140 Japanese fifth-grade children watch an educational television program about the Tokyo-Yokohama industrial area. Comparison of pretest and posttest showed substantial increase in the students' knowledge.

In Italy, Mura (1961) observed pupils attending courses of a telecast program, "Non e mai troppo tardi" (It is never too late), over a period of three years. He found positive results achieved by television in overcoming illiteracy.

Bertran (1962) examined the use of closed-circuit television for training of teachers in France. He found that the presentation of a course on television forces the teacher to be concise, to improve his method, and brings out the essential points of his lesson.

Examples of research comparing TV instruction with conventional instruction, where significant differences were found

Pasewark (1957) conducted an experiment on teaching typewriting by television. Both the TV group and face-to-face group received 48 hour-long typing lessons from the same instructor. At the end of the course, the television group students typed significantly faster than the face-to-face group students.

Meacham (1963) compared students in a clothing construction class. The television group did significantly better on laboratory performance than the face-to-face group although in objective information tests the two groups showed no difference.

Kanner, Runyon, and Desiderato (1954) reported on an experiment in which 400 army trainees were taught basic military skills either by television or by conventional instruction. In five of 17 tests given, the TV group scored significantly higher. In the remaining 12 tests no significant differences were found.

Herminghaus (1957) compared ninth-grade students in a composition class. Those students who were taught face-to-face scored significantly higher than the TV-taught students.

In an experiment by Gordon (1960), students in 20 Hawaiian schools who had pronounciation problems were taught remedial speech by either television or their own regular teachers. The same jury rated the students' tape-recordings before and after the remedial program. Students taught by television had an average gain score of 9.8, as compared with a slight average loss of 0.4 for students taught by their own teachers.

Gottschalk (1965) reported that college students learning German from closed-circuit television did significantly better in aural and reading comprehension than students taught by the conventional method. However, the two groups had no differences on written finals.

Stake (1959) compared high school students taught elementary Spanish vocabulary by television with face-to-face taught students. The TV group had significantly lower scores than the face-to-face group.

Wetter and Gable (1958) reported that junior high school students taught mathematics by television scored significantly higher than did face-to-face students.

Jacobs, Bollenbacher, and Keiffer (1961) tested the effectiveness of television in teaching mathematics to below-average junior high students. No significant differences were found between the television and conventional groups on the computation section of the test. In two of five comparisons on problem solving and concepts, the TV-taught classes did significantly better.

Johnson and Harty (1960) reported that high school students taught geometry by face-to-face instruction did significantly better than the TV-taught group.

Suchy and Baumann (1960) conducted a three-year experiment in which high school students were taught American history either by television or by conventional instruction. In both the first and the second year, the TV group scored significantly higher than the conventional instruction group.

In an experiment conducted by Pinto(1962) in Chile, high school students were taught history of the Middle Ages and modern times. On questions related to interpretation and description, the TV-group students did significantly better than the two groups taught without television.

Johnson (1960) reported that students taught introductory geography by conventional instruction had significantly better achievement than students taught by television.

Abe (1960) compared two groups of Japanese students randomly assigned either to a television program or to a lecture by the same professor. The program was about elementary psychology concerning the mind. The lecture group did significantly better than the TV group.

Boone (1954) reported that Naval Academy midshipmen receiving instruction on electronics from television scored significantly higher than did the face-to-face group.

Macomber (1956) compared television instruction and conventional instruction in a college human biology course. He found that the TV-taught students scored significantly higher than the face-to-face students.

Woodward (1964) reported that the achievement of face-to-face students in biological science was significantly superior to that of TV-taught students.

II. What Have We Learned About the Efficient Use of Instructional Television in a School System?

Let us turn now to some of the very broad conclusions about the use of instructional television which seem to emerge from the evidence. These derive most often from case studies and experience reports, rather than from the type of experiments which we have been reporting and to which we shall return again in the next chapter. Nevertheless, these are conclusions which may be of great practical import for users.

4. TELEVISION IS MOST EFFECTIVE AS A TOOL FOR LEARNING WHEN USED IN A SUITABLE CONTEXT OF LEARNING ACTIVITIES AT THE RECEIVING END.

We remarked in the preceding section that hardly anywhere in the world is television being used to carry the *whole weight* of instruction. Almost invariably, where it is being used effectively, it is built into a teaching-learning-system. The teaching that can be done best by television is provided that way: what can be done better by face-to-face teaching or group supervision is provided *that* way.

Thus in Samoa and Hagerstown, where television provides the core of the entire curriculum, television itself fills only ten to 30 minutes of the class period (less in the early grades, more in the higher ones). The rest of the time belongs to the classroom teacher, and great efforts are made to coordinate the work of the studio teacher and the classroom teacher. In Chicago, where television comes probably as close to carrying the entire weight of teaching as it does anywhere, the Chicago Junior College found it necessary to set hours during which television students could consult instructors by telephone, to arrange for most classes a few meetings on campus during the term, and to arrange to have papers written and corrected as in campus teaching. (See case studies by Schramm, Nelson, Odell, Vaizey, and Spaulding, 1967; Wade, 1967; McCombs, 1967).

In Italy, where Telescuola taught secondary education to pupils who were out of the reach of secondary schools, and literacy to adults, learning groups were organized in both cases; and the quality of group supervisors was gradually upgraded from monitors to certificated teachers. (Lyle, Kahnert, Benton, and Bertola, 1967).

In Peru, where school dropouts and children unable to obtain places in schools were taught by television, it was found that the effectiveness of these classes was greatly increased when children could come to a two-hour class on Saturday mornings at which they were given face-to-face teaching. (Lyle, Germanacos, Kahnert, and Torfs, 1967).

In Japan, where an entire secondary school curriculum is offered by television and correspondence study, the greater weight is carried by the correspondence work, and the television serves to supplement, explain, and motivate the students, and to maintain schedules. (Schramm, Amagi, Goto, Hiratsuka, and Kumagai, 1967).

The experiments mentioned in the previous section, in which apparently unlikely subjects such as speech, typewriting, chemistry laboratory, and driver education were taught successfully by television, used it in this same way – to carry *part* of the weight of the course, the responsibility being divided between the studio and the classroom in whatever seemed to be the most desirable combination. Obviously, then, one of the keys to efficient use of instructional televison would appear to be the coordination of studio and classroom, and the joint planning and continuing communication between studio and classroom teachers. In fact, after completing 23 intensive case studies in 18 countries, a group of authors representing the International Institute for Educational Planning stated this conclusion:

> "In effect, then, by their very nature the new educational media enter into a kind of team teaching. It is not precisely the kind of teaching usually called 'team teaching' in modern schools, where the term usually refers to the division of specialized responsibilities for a large group of pupils among a group of teachers and assistants. But the principle is the same. Each teacher has a special task which, supposedly, he can do best. In the case of the media, a teacher at the point of input, a teacher at the point of reception, perhaps another teacher speaking though textual or exercise materials, combine their efforts, each doing his own part of the task of stimulating students' learning activity. When the media are used for adult education (let us take agriculture as a possible subject area) the teacher at the transmitting end may be an extension specialist, the supervisor at the receiving end may be a forum chairman or village-level worker, and the materials may be prepared by a group at the agriculture research station. But the division of responsibilities is the same. Obviously such a division and combination of responsibility requires a clear and common set of learning objectives, the will to work together, careful planning, and adequate training in the special skills required." (Schramm, Coombs, Kahnert, and Lyle, 1967, p. 97).

This approach represents something of a shift in emphasis in the study of instructional television. Most of the experiments in the field, following along the line of instructional film experiments, have been concerned with program content – what goes into television at the transmitting end. What we are saying in this section, and what derives from such cases and experiences as have been mentioned, is that the amount of learning from television depends at least as much on what happens *at the receiving end.*

Now, of course, most of the experimenters who have worked with television and film content have not been content to follow the old hypodermic theory of communication. They know that attaining a learning result from television is not so simple as injecting facts and concepts into a passive pupil. Learning is an active thing. Learners come to television with different goals and different motivations, and both the broadcast and the classroom content must try to stimulate and direct the learner's own activity.

There are experiments as well as case studies to demonstrate this. For example, when Colombia offered new math by television to its teachers as part of their in-service training, a great deal of learning took place among teachers who watched the programs individually. However, if teachers watched in groups and then discussed the programs afterward, there was significantly more learning; and if a group had a chairman or supervisor to direct the discussion, there was still more learning. (Comstock and Maccoby, 1966b).

It is only common sense to conclude that if part of the teaching is to be done in the classroom, then the kind of teaching that goes on in the classroom will have something to do with the total amount of learning. But there has been less research than one might expect on the interface of television with classroom activities: What are the most effective ways of combining these two elements of a course?

In film research there are studies of the usefulness of a teacher introducing the film and then conducting reviews or discussions afterward. In general, these activities can be conducted in such a way as to increase the amount of learning from the film. For example, a carefully designed experiment in Australia (Commonwealth Office of Education, 1950) found that introducing the film, showing the film, class discussion immediately thereafter, and repeating the film 24 hours later, was the most effective of six ways to use the film as a part of class work. The Michael-Maccoby experiment (1953) found that stopping a film at intervals for overt or covert review resulted in significantly more learning than merely seeing the film through. A study on the effectiveness of teaching the use of the slide rule with the aid of a film found that *guided* practice after seeing the film resulted in significantly more learning than unguided practice (Kimble and Wulff, 1953). A study on the use of a film to teach Air Force trainees about maps (Levine, 1953) found that active review of the subject matter after the film would considerably increase learning.

Most of the research on this topic has dealt with film, but there is little doubt that most of the conclusions can be transferred to television. In the case of television itself, there are experiments (for example, Gropper and Lumsdaine, 1961b) to indicate that learning can be increased by building the opportunity for active responses into the televised program itself. The Hagerstown experience (Hagerstown, 1959) has shown that when the televised teaching was so designed that pupils would respond to the studio teacher, then this discussion would, after the televsion part of the class, be projected or transferred to discussion with the classroom teacher and the other pupils. From numerous case studies and experience reports (for example, see Schramm, Coombs, Kahnert, and Lyle, 1967) has come evidence that the attitude of the classroom teacher toward the televised part of the class has been transferred to the pupils and been reflected in the effectiveness of the use made of the television. And finally, one of the more elaborate studies of context of instructional television, Denver's experiment with foreign language teaching in the elementary schools, found that different "packages" of classroom activities built around the television made significant differences in the total amount of learning. Thus, in the first year of language study, teacher-directed classroom practice (using any one of several drill styles) plus electronic aids (tape recorder or discs) was highly effective. In the second year, programmed instruction plus teacher-directed practice plus some other activity to provide variety, was a highly effective combination. But the general conclusion of the experimenters was that "a well-trained and motivated classroom teacher is the most effective single learning aid." When the television part of the course was held constant, "both the interest and the experience of the classroom teacher influenced learning." (Hayman and Johnson, 1963a; also Schramm and Oberholtzer, 1964).

5. TELEVISION IS MORE LIKELY TO BE AN EFFICIENT PART OF AN EDUCATIONAL SYSTEM WHEN IT IS APPLIED TO AN EDUCATIONAL PROBLEM OF SUFFICIENT MAGNITUDE TO CALL FORTH BROAD SUPPORT

It may well be the size, rather than the nature of the educational problem television is used to solve, which relates most closely to its efficiency.

It is now clear that television can be used to help with a great variety of the problems that educational systems and educational ministries have. For example, the series of case studies to which we have previously referred found instructional television being used in the following areas:

Upgrading instruction	Teaching teachers	Extending the school	Literacy and fundamental education	Adult education and community development
Colombia	Algeria	Chicago	Italy	Colombia
Hagerstown	Colombia	Italy	Ivory Coast	Italy
Niger	Hagerstown	Japan	Peru	Peru
Nigeria	Italy	Peru		Samoa
Samoa	Nigeria			
MPATI	Samoa			

In each of these groups there was sufficient evidence of success to indicate that television, if used well, can effectively contribute to any of them. (See Schramm, Coombs, Kahnert, and Lyle, 1967, pp. 17-92).

What is television contributing to the solution of these problems? Essentially, it is sharing and distributing teaching. It is serving as a pipe through which superior teaching, elaborate demonstrations, and otherwise scarce subject matter can be distributed more widely than would otherwise be possible. There is no magic about it except the relative efficiency with which it can deliver teaching-learning experiences over wide areas; as we shall see later, this distributive efficiency is one of the qualities that distinguishes instructional television from instructional films.

Let us look at a few examples:

Niger has only about 10 per cent of its children of school age in classes. It is anxious to bring as many as 300,000 additional children into school, and to build up its secondary education. But in the entire country there are only 66 teachers who have themselves had secondary education, and little chance of getting any more in the next decade or so because the other needs of a new country for the few secondary school graduates have higher priority than the schools. In this situation, there is every reason to think of sharing the best teachers as widely as possible. And this is what Niger has set out to do: using some of its best teachers to give the core of instruction on television, using less-well-trained ones to supervise the classroom learning activities built around the television, and to extend the televised teaching one grade per year.

American Samoa is trying to jump from a traditional rote-learning type of educational system into modern education – not in the hundred years or more it would ordinarily take, but in a decade or two. Almost its entire native teacher corps has come up through the traditional system and could not itself make such a dramatic change. Therefore, Samoa has consolidated its one-room schools, installed a six-channel television system, and brought in expert studio teachers to give the core of the curriculum. At the same time it is helping the Samoan teachers with in-service training and teaching materials to provide an adequate classroom context for the television and to improve upon their own preparation until they can handle a different level of teaching.

Colombia is trying to do much the same task, although limited to a few key courses, and using native teachers both for studio and classroom. Approximately 400,000 Colombian students are now being taught in part by television.

Ivory Coast, building new industry, needed 700 new supervisors in a hurry. These men had to be able to read and write, and do simple arithmetic. The industries provided television receivers and rooms where the prospective supervisors could take fundamental education courses. The best of the country's few fundamental education teachers were put on television. The courses moved forward urgently, and now the last of the new crop of supervisors are entering upon their responsibilities.

About half of *Italy's* 8,000 communes have no secondary schools. This is especially serious in remote areas which are too isolated to permit children to attend schools in neighboring communes. To serve such areas, the Centro di Telescuola began in 1958 to broadcast a full curriculum for the first three years of secondary school, to learning groups organized in these remote areas and presided over by monitors or teachers who share the responsibility with the teachers in the studio.

Hagerstown was neither the best nor the worst among United States school systems when it went into television in 1956. It wanted to be able to offer science throughout elementary as well as secondary school; foreign language beginning early in the elementary grades; art and music expertly taught in all schools; some advanced work in mathematics and science in high school. Many of its elementary teachers were not prepared to offer up-to-date courses in science or to teach foreign languages; and it was very short of well-qualified art and music teachers, as well as others. To hire teachers for these places would have been a very large addition to the budget, even if they could have been hired. Furthermore, it was necessary to build new schools, and the question arose whether some space and money could be saved by designing the buildings around large areas for television viewing plus small rooms for group teaching and discussion. When the opportunity came to go into television, and share its best teaching more widely, Hagerstown jumped, and has since been amply satisfied with the results.

Algeria lost 80 per cent of the foreign teachers who had predominated in its teacher corps when it became an independent nation. Nevertheless it went ahead bravely with a plan for universal education. It recruited 10,000 native monitors, and then seized upon every way it could find to provide in-service training for them. Among other things, it used television where it could, in combination with programmed instruction, correspondence study, and study groups.

It is in cases like these – all-out attacks on large and challenging educational problems – that television seems to be making its greatest impact on education, and, most observers would say, having its greatest success.

By contrast, it is much harder to find evidence of impact and success where television is being used in a small way, tentatively, and for supplement rather than direct teaching. This is not to say that television cannot be used effectively for curricular supplement; only that it is harder to find satisfying evidence of impact when it is so used.

Admittedly these conclusions are not based upon a great deal of experimental research evidence; rather, they derive from case studies and comparative observations, buttressed by such hard research as can be found.* But assuming that they represent acceptable propositions within the present state of evidence, what is their significance?

For one thing, it has become clear that effective use of instructional television in a school system requires broad support – administrative, financial, and teacher. It is much easier to get the needed support if the objective is demanding and urgent.

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*Among the cases cited, a considerable amount of hard research exists for Colombia and Hagerstown, smaller amounts for Niger, Samoa, and Algeria.

This is nowhere more obvious than in the case of administrative support. If instructional television is to play any large part in a school system it needs strong support from the top. When representatives of Niger and American Samoa were comparing their experiences at the Paris conference on television, in March of 1967, it became apparent to both of them that the principal reason Samoa had gone ahead faster was the firm support of Governor H. Rex Lee for the project. In contrast, Colombia's first trial at instructional television failed when the only high-ranking government-supporter of the project went out of office in a change of government. The countries where instructional television is having its hardest times are, for the most part, those in which the government has lost its interest in the educational side of television, or where responsibility for it is divided among ministries and none of them feels obligated to defend and advance it.

On the other hand, where television is being used for a generally recognized need, as in most examples just given, top administration has no difficulty supporting it and calling for national or system-wide support for it just as one might call for support in time of war. In Samoa, Niger, Algeria, and others we have named, television is at war against educational needs of great magnitude and importance. It is easy to decide to get behind it.

Major needs, major campaigns, strangely enough make it easier to get teacher support also. Instructional television has seldom if ever come into use without some resistance from teachers. This is because it is basically threatening. Supplementary use of television at the volition of the classroom teacher, is less threatening than direct teaching by television. It has behind it the precedent of the use of films, which can be brought into the classroom, if available, when the teacher wishes, and used or not according to preference. But direct teaching by television requires a teacher to share her classroom with a new and attractive teacher on the picture tube. It requires her to make her schedule and pace conform to that decided upon for the entire system. It requires her to learn a new role – to give up some of the "telling" and spend more time on the discussion, practice, guidance that must necessarily take place in the classroom rather than on the television channel. Some teachers feel this is a degrading role; particularly in upper secondary and higher education, where teachers are proud of their subject-matter expertise, it is likely to be thought degrading. If the objective is obviously important, if the use of television is large enough that anyone can see it is being taken seriously, then it is easier for a classroom teacher to put aside his objections, make his schedule fit, learn the new role; in effect, he is enlisting in the war against an educational enemy that must be defeated. If the objective is not urgent, if the new medium is being used tentatively, then it is much easier for a classroom teacher to drag heels or decline to cooperate.

Finally, a worthy target and a large program make it easier to justify the financial backing television needs. A small program is likely to show high unit costs, and if it also shows few results then there is very little reason to keep on voting the budget. Television is a mass medium; to be used efficiently, it must be used in a large way. The basic expenses cannot be cut beyond a certain minimum. Quality cannot be achieved without a certain minimum investment. Therefore, the strategy of efficient television use is to direct the tool toward large goals and many users, and thus justify both costs per user and total costs against the objective.

In other words, there is a certain size below which instructional television is hardly feasible, and a certain critical mass which it must reach before we can expect it to be truly effective. This may help to explain why many of the most exciting uses of the medium are likely to be seen in developing countries, rather than countries like our own where the most probable users are the school systems that least need instructional television – the wealthy suburban districts – and where the pattern of use is most likely to be either tentative and suspiciously received direct teaching by television, or supplementary use in the pattern borrowed from films.

"Under any careful scrutiny," says the IIEP volume previously quoted,

> "the new educational media are most likely to commend themselves for use in a context of change. They are not likely to save money or have a great deal of impact if they are merely added on to do a little better what is already being done. Not that enrichment and supplementary uses are not justifiable; films and television, for example, have often proved useful in supplementing and deepening direct teaching, as on a lower level of cost and complexity the use of cut-out pictures and home-made learning aids has often made exciting differences in classrooms that have not been accustomed to any teaching aids (the UNRWA schools are examples). But the broadcast media, especially, are most likely to be used at their full power and efficiency when a system is trying to solve stubborn, basic problems or to bring about some fundamental change. That is to say, they are likely to be most attractive economically, and most useful educationally, when they are employed, for example, to help extend educational opportunities to those who lack them, to upgrade the level of instruction significantly, to improve and update large numbers of teachers, to introduce new subjects or a new curriculum – in other words, to do something distinctly and significantly new. This is why the new media are especially attractive to developing countries, even though the scarcity of economic and technological resources and of trained persons make it more difficult to introduce them there. But even a more developed school system will do well to follow the strategy of concentrating the potential of its new media on the most urgent 'change point' in the system – that is, the places where educators agree that change and improvement are strongly needed but most difficult to achieve by ordinary means. Herein lies the basic difference between an 'enrichment' approach and more strategic and advantageous uses of the new educational media." (Schramm, Coombs, Kahnert, and Lyle, 1967, p. 98)

6. TELEVISION IS MORE LIKELY TO BE AN EFFICIENT TOOL OF LEARNING IF IT IS PLANNED AND ORGANIZED EFFICIENTLY.

This seems obvious, and yet it sums up a high proportion of the conclusions from the case studies and observer reports. It should be explained that there are in the literature two general kinds of observer reports, as distinguished from controlled experiments and surveys. One of these is project reports. The available literature now contains approximately one hundred of these, which are prepared by the project staff and are, of course, not critical of what has been done. The other type includes case studies, the majority of which are included in the IIEP volumes we have been citing, and reports from outside observers, many of whom bring expert knowledge to bear on the project but whose reports are more likely to be in the files of sponsors, foundations, or government agencies than in the literature. In this section we shall try not to go beyond what is said in published reports.

These reports have a high incidence of conclusions like these:

a. School systems typically "muddle into" television without adequate planning. The lead time needed for setting up an instructional television system is almost always underestimated. Typically the controlling event is getting the hardware financed, delivered, and operating; the software follows along that schedule. Very often the patterns of use are controlled by the available hardware, rather than the reverse.

b. Inadequate attention is given to methods and content of television teaching. Typically there is not time for a review of curriculum and method, when a school is hurrying to get television into use. But this is an unequalled opportunity to review what is to be taught, against the goals and objectives of the system, and to review and recast the methods of teaching that have grown up over the years. Television will probably provide more time for preparing a course than teachers have ever had before; and to a certain extent will require new teaching methods anyway. Therefore, it seems like the ideal time to take a fresh look at the teaching.

c. Too little attention is given to mastering the skills of effective teaching by television. A classroom teacher, without previous experience in using television, needs to learn a great deal about the medium, needs to observe himself as a television teacher and to make maximum use of feedback from pupils and other teachers, and to do a great deal of preparation so as to make his broadcast more than a talking face. He needs to gather visuals, to arrange demonstrations, interviews, other variety-producing devices. One of the interesting things done in American Samoa to help teachers learn the skills of television is to record beforehand all programs for broadcast so that a studio teacher can, whenever he wishes, go to a classroom and observe his own performance and the class reaction to it. Most systems arrange for comments to come back from classroom teachers. But the most important time of preparation comes before the class actually goes on the air, and this is what is most often neglected.

d. Too little time and money are allotted to training for the instructional use of television. It has often been noted that the personnel of instructional broadcasting consists largely of educators who do not fully understand television, and broadcasters who do not fully understand education. The product most needed is the combined broadcaster-educator. The studio teachers need to combine these understandings. The officials in charge of administering the policy, deciding the content, organizing the system, need to combine them. Yet these combinations are in short supply, and school systems seldom are able to take the time – before television – to give any of their key personnel an opportunity to master them.

Perhaps the greatest lack is training for the classroom teacher in the new role he must assume with the coming of television. In some developing countries, as the cases have shown, this is a very difficult problem, because many classroom teachers must learn to do a kind of teaching they have never done before. In economically advanced countries, the teachers already have the skills, but must learn – and accept – a new approach. In any case, the efficient preparation of classroom teachers for the use of television usually includes some workshop training beforehand, a flow of materials to guide classroom practice related to the television, and continuing contact with the central curriculum office and in-service help and advice throughout at least the first years of the television experience. The more successful projects seem to budget a healthy amount for continuing two-way contact between the classroom teacher and the studio center.

e. In many systems there is too little attention to technical adequacy, especially to set maintenance. This is less often true in industrially developed countries than elsewhere, although even in some of the most advanced countries school systems have tried to get along without adequate technical help or supplies. In developing regions, however, the lack of technical preparation is often a fatal flaw. Television in such regions varies all the way from American Samoa, which has one of the finest television installations in the world, to a country – we shall not mention the name – where neither the studio nor the school can tell from one hour to the next whether the power will be on in any given area, and where there has been so little attention to repairs and maintenance that at any given time as many as two-thirds of the receiving sets may be inoperative. Maintenance of receivers is a serious problem in almost every developing area.

f. Systems are typically under-used. In this respect, it would be useful for a prospective user of instructional television to examine Chapter 4 of the Schramm, Coombs, Kahnert, and Lyle volume previously cited. This reviews the cost analyses of a number of new media systems, and concludes that most systems have unused technical capacity, and that both users and programs could be added at very low unit costs. This is, of course, a function of planning. The principle needs to be borne in mind, however, that whereas it is all right to start with a pilot project, still television is economically more efficient when used as a mass medium.

g. There is too little effort to measure the results. For a research man, this is very hard to understand. A great deal of money is being committed; risks are being run with resistant and hostile attitudes; policy decisions will have to be made at frequent intervals to determine whether the project goes on, and if so in what form. It would seem, therefore, that reliable information on what television is accomplishing would be one of the priority needs of the system. From the standpoint of a schoolman, it is a little easier to understand. Research costs money. It is often slow in coming up with results, cloaked in esoteric jargon, and far too qualified in its conclusions. Typically, school administrators and school boards have been more likely to trust observation and educator opinion. This is a great pity, because already we have lost the opportunity to collect solid information that could guide future use of the medium. What is needed is a rapprochement between educators and researchers. There are systematic ways to gather information on the results of televised instruction that are not expensive, and, if it is planned from the beginning, often research can be built into a school's use of television with very little requirement of additional funds. It is not necessary, in many cases, to have an outside contract and an outside research organization. Neither is it necessary to base policy on opinions which may or may not be informed or biased.

These, as we have said, are conclusions of the analytical studies and the expert observers. They are not so easy to support as are many of the conclusions of more quantitative research, although they are easy to document, and to do so one need go no farther than the collection of 23 case studies now perhaps too often mentioned. Let us now turn back to the findings of experimental research.

III. What Have We Learned About the Treatment, Situation, and Pupil Variables?

From what we know on the basis of hundreds of studies, it seems that the question facing educators today concerning instructional television is not whether a teacher can teach efficiently on television. There can no longer be any doubt about this. The question, rather, is how to make the most effective use of television as an instrument of teaching. In the preceding chapter we have seen some case studies in which attempts are made to build television into the overall teaching context, as part of team teaching. Now we are going to look at a number of controlled experiments in which the various aspects of instructional television are examined one at a time. Not all the results of these experiments are conclusive, but together they provide enough information to suggest how television can be most effectively utilized in the classroom.

The experiments we are going to discuss fall into several categories. For one, there are experiments which deal primarily with the physical and technical aspects of instructional television, for instance, magnification of the visuals, the size of the screen, the use of color vs. black-and-white, the angle of the camera, and the use of irrelevant cues.

Then there are those experiments which investigate certain pedagogical variations that are made feasible through the use of television. For instance, the use of humor and animation, the repeated showing of the same lecture, variations in the program length, differences in the sequence of material, dramatic vs. expository presentation, and the use of inserted questions.

A third category has to do with the environment under which the viewing takes place. For instance, the viewing angle, the viewing distance, the noise condition, the size of the class, viewing at home vs. in school, the homogeneity or heterogeneity of the viewing group, permissive vs. required viewing, and motivated viewing.

Then there is the problem of student-teacher contact. In what way would the lack of immediate feedback limit the effectiveness of teaching and effectiveness of learning? Would the absence of contact with the television instructor reduce the amount of emotional support the student feels he is getting? How would this lack of emotional support affect the student's incentive for learning?

Finally, we have those experiments that deal with variations in the students' responses. What should the students do when they are viewing the televised lecture? Should they take notes? Should they respond overtly, covertly, or not at all? Is there an optimal combination of responses the students can make in order to achieve the best results of learning?

Sometimes, on the basis of research findings, we are able to offer some tentative conclusions. Often the results of different experiments are not quite consistent with each other, and all we can do is to offer certain propositions that appear to take into account the seemingly contradictory findings by different researchers. In some cases, our empirical knowledge is so fragmentary and incomplete that we can only point out the areas where further research will be needed to clarify certain essential points.

7. THERE IS NO EVIDENCE TO SUGGEST THAT EITHER VISUAL MAGNIFICATION OR LARGE-SIZE SCREEN WILL IMPROVE LEARNING FROM TELEVISION IN GENERAL.

On intuitive ground, one advantage which television might seem to have over face-to-face instruction is its ability to magnify certain key images about the objects to be learned, so that the students can see them more clearly. For instance, Brown (1958) has argued that close-up work is among the advantages of televised instruction. And the use of closed-circuit television in medical schools for the observation of surgery is now a common practice. But such research as we have evidence does not seem to bear out these common sense expectations.

Diamond (1962) used television as a magnifying device for laboratory demonstration in a human anatomy course, and compared it with face-to-face laboratory. Although the low-ability students in the TV group did significantly better than the low-ability students in the face-to-face group on one test, there were no significant overall differences between the two treatments.

In another experiment, Carpenter and Greenhill (1958) compared a group of college students in an education class who received face-to-face lectures and magnified visuals on television, with another group which received regular instructional television. There were also no significant differences between the two groups. It may be pointed out that in this case the effects of magnification were confounded by face-to-face teaching.

Aylward (1960), using college students in a public speech class as subjects, found that the size of image made no difference to learning from television.

A problem related to visual magnification is the size of the screen. Will large-screen television bring about better results of learning than regular size television?

From the few experiments available, all conducted by Pennsylvania State University, it appears that the size of the screen makes little difference. In one of the experiments (Greenhill, Rich, and Carpenter, 1962), students in a zoology course and an accounting course were randomly assigned to either Eidophor large screen or regular 24-inch receivers. Analysis of covariance found no significant differences between the two treatments for either the zoology course or the accounting course.

As part of the same experiment, 180 students in the zoology course were divided into two groups, one for large screen, the other for 24-inch receivers. After six weeks, the two groups changed places. At the end of 12 weeks, the students were asked to indicate their preference. A majority of them, 77 per cent, chose the large screen, and only 23 per cent preferred the 24-inch receivers. However, preference was not related to achievement in the course.

In another experiment (Reede and Reede, 1963), students enrolled in elementary economics at Pennsylvania were assigned to either Eidophor large screen or 24-inch receivers. No significant differences were found in the overall achievement scores of the two groups. However, on the problem-solving portion of the tests, the large-screen group did significantly less well.

The general finding from all these experiments appears to be: Neither magnification nor large screen has any special contribution to learning in general. However, one type of learning may conceivably be aided by magnification. This is the learning of a skill that requires the manipulation of a particularly small object. It would seem that if the intricate components of the object can be magnified on film or television, the pupil will be able to recognize and manipulate them more easily.

Although we have no direct research evidence to support this hypothesis, the findings by Le Master (1962) on the learning of wood-working seem to suggest that this may very well be the case. High school boys were taught woodworking by the same instructors with or without the use of filmed demonstrations. On the basis of test results, the author suggested that the filmed demonstrations helped the pupils to use manipulation skills more effectively. We might assume that this is because the films showed the woodwork task more clearly to the pupils.

This assumption is further supported by the experience of medical schools which have used television to let a large number of students observe what previously could be seen by only a few students in the surgical ampitheatre.

8. THERE IS INSUFFICIENT EVIDENCE TO SUGGEST THAT COLOR WILL IMPROVE LEARNING FROM FILM OR TELEVISION.

Another possible way to improve the effectiveness of televised teaching is the use of color. Perhaps the black-and-white images on the TV screen do not provide as vivid an impression as the real life objects because of the lack of color.

In one of the earlier experiments, Vander Meer (1954) presented films on science lessons to high school students either in color or in black and white. Learning was measured by both verbal tests consisting of multiple-choice items, and nonverbal tests such as identification on maps, identification of sulphur types in glass vials, and identification of slide pictures of snakes.

On the immediate verbal posttests, no significant differences appeared between those students who saw the color versions and those who saw the black-and-white versions, although the latter tended to score somewhat higher. For two of the three nonverbal immediate posttests, the black-and-white group means were significantly higher than the color group means. For the delayed posttests given six weeks later, three out of five comparisons of verbal test scores were significantly in favor of the color group. No significant differences were found on the delayed nonverbal tests between the two versions.

In a follow-up experiment, half of the students saw two films in color and two films in black and white, while the other half saw the same films in opposite versions. No difference in learning was found between the color films and black-and-white films either by verbal or nonverbal immediate posttests. No delayed posttests were given.

Vender Meer found that the students preferred color films to black-and-white films, but there was no correlation between preference and learning.

In a subsequent experiment by Fullerton (1956), the comparative effects of color films and black-and-white films on retention were further tested. Four films, on library organization, heredity and environment, choice of occupation, and earning power, were shown to high school students either in color or in black and white. Analysis of covariance indicated that students in the black-and-white groups scored significantly higher on both the immediate posttests and delayed posttests given six weeks later.

More recently, Kanner and Rosenstein (1960) put the effects of color to a more rigorous test. A total of 368 army trainees were matched in pairs and randomly assigned either to color or black-and-white television presentation. The trainees were tested over each of the 11 lessons. Some of the questions were designed particularly to assess the influence of color on learning. Of the 11 comparisons, 10 yielded no significant differences, the remaining one favoring color presentation. The two groups had about the same number of correct answers on color and noncolor test items. The low-ability trainees tended to learn more from color, while the high-ability trainees tended to learn more from black and white.

In a later experiment by the same authors (Rosenstein and Kanner, 1961), military and civilian personnel at a guided missile school were matched and randomly assigned to either color or black-and-white treatment. Both groups watched the same 15 lessons on guidance and repair of Nike missiles, and took tests immediately after each lesson. This time, no significant differences were found for any of the 15 lessons. Nor were there any definite trends to suggest whether the low-ability individuals will learn more from one treatment, or the high-ability individuals will learn more from the other.

An experiment conducted among high school students in Toronto had similar results. Link (1961) divided ninth-grade students into three groups: One saw four films in color, one saw the same films in black-and-white via closed-circuit television, and the third group saw both. The group that saw both versions learned significantly more than the other two groups, but there were no significant differences between the one that saw the color films and the one that saw the black-and-white versions.

From these experimental results, it seems that the use of color in film or television does not significantly improve learning. Even though Vander Meer found some evidence suggesting that color presentation may contribute to retention, his findings were not entirely clear, and failed to be replicated. In fact, the results by Fullerton suggest the contrary. If we look at the results from the more carefully controlled experiments by Kanner and Rosenstein, we can see no particular advantage of using color presentation, at least from the learning viewpoint.

Whether color television will make for more favorable attitudes seems to be a different story. The findings by Vander Meer on the students' preference would suggest that color may very well bring about more favorable attitudes toward instructional television.

However, while saying that color does not seem to improve learning in general, we must not overlook the possibility that in certain particular learning tasks, color may play an essential part. For instance, certain substances, like blood, have no definite shape and can only be identified by color. A black-and-white presentation would therefore be greatly handicapped. Or, sometimes color will be necessary to make a particular object stand out in order to be recognized. In these situations, a color presentation will be necessary. Otherwise, the cost factor would favor the black-and-white version.

9. WHERE LEARNING OF PERCEPTUAL-MOTOR SKILLS IS REQUIRED, A SUBJECTIVE ANGLE PRESENTATION ON TELEVISION WILL TEND TO BE MORE EFFECTIVE THAN AN OBJECTIVE ANGLE PRESENTATION.

One problem in the learning of manual skills is the angle from which the student views the demonstration of the skill. For instance, in teaching the tying of a knot, should the camera present the knot-tying from the angle the performer himself sees it, or from the angle the observer sees it? The two are exactly opposite. A few experiments have looked into this problem.

Roshal (1949) designed an experiment in which he compared the two different camera angles. Navy recruits were taught to tie three different knots by different versions of the same film. The results showed that the subjective angle, that is, the one presenting the knot from the performer's eye-view, was superior to the objective angle as seen by the observer.

In an earlier experiment, Gibson (1947) compared the effectiveness of a film, an illustrated lecture, and an illustrated manual in teaching position firing to aviation trainees. While the three conditions were not strictly comparable, Gibson suggested that the superiority of the film was due to the fact that the training situation was viewed from the same angle as in actual combat.

However, a more recent experiment by Grant and Merrill (1963) had somewhat different results. Two groups of registered nurses watched the same nursing team leader conduct a nursing care conference on television. The two presentations were identical except for the camera angles. The subjective angle portrays the task of the team leader from the viewing angle of the leader herself. The objective angle portrays the leader's task from the viewing angle of the student nurse seated opposite her. Test results showed the objective angle was more effective in bringing about recognition learning.

It seems that where the learning involves only perceptual-motor skills, the subjective angle is apt to be more effective, as Roshal and Gibson have found. If the subject matter is more complex than perceptual-motor skills, as Grant and Merrill suggest to be the case in the conduct of the nursing care conference, then the advantage of the subjective angle appears lost. However, it is not quite clear why the objective angle should yield better learning in this particular case. We need further research to clarify this point.

10. THERE IS NO CLEAR EVIDENCE ON THE KIND OF VARIATIONS IN PRODUCTION TECHNIQUES THAT SIGNIFICANTLY CONTRIBUTE TO LEARNING FROM INSTRUCTIONAL TELEVISION. HOWEVER, STUDENTS WILL LEARN BETTER WHEN THE VISUALS ARE PRESENTED IN A CONTINUOUS ORDER AND CAREFULLY PLANNED BOTH BY THE TELEVISION TEAM AND THE STUDIO TEACHER.

Because television can make use of various film techniques, the question can be raised as to whether some of these techniques might make for more efficient learning.

Ellery (1959) designed an experiment to answer this question. He prepared different pairs of 8-minute television films, each pair being identical except for one production technique. In one pair, he compared a technique called dollying, that is, continuously moving up the camera from a long shot to a close-up, with a technique called cutting, that is, cutting up the two different shots. In another pair, he compared a version having no production error, with a version having production errors. Another comparison concerned the background of the scenes: a limbo set, where no attempt was made to create any actual setting, vs. a nonlimbo set, where a normal, actual setting was used. Finally, key lighting, where the light was focused directly on the subject, was compared with flat lighting, where diffused light was used. The subject matter taught was speech. The televised lectures were watched by high school students. In none of the comparisons were there any significant differences found, either in immediate posttests, or in delayed posttests.

Cobin and McIntyre (1961) found that students – at the college level – preferred simple production techniques, rather than a variety of shots.

An earlier experiment by Mialaret and Melies (1954), using French school children as subjects, compared three versions of the same film varying only in the complexity of film techniques. The film was about the story of a little girl waking up in the night, going up to the attic to dance, and finally put to bed by her mother. It was found that when many film techniques were used, the children found it almost impossible to locate the elements of the stage set.

The only experiment that found significant differences was the one by Schwarzwalder (1960). This study compared three different techniques of presenting fifth-grade science lessons on television. One was visual continuity, where camera shots were arranged in a planned order, vs. an unplanned random order. Another was visual reinforcement, where superimposed materials were used, vs. no super-imposed materials (the teacher being seen most of the time). A third concerned the manipulation of visuals, either by the studio teacher in a way similar to regular classroom use, or in a way carefully planned by the television team and the studio teacher. The same teacher taught all the lessons.

Test results showed that students did significantly better when they viewed the lessons that demonstrated planned visual continuity, contained visual reinforcement, and had been the result of a team approach to make effective use of the television medium.

The results from these experiments would indicate that by and large, the many film techniques do not significantly contribute to learning. Most of them either add nothing to the amount of learning, or, in case the students are small children, may even cause considerable confusion. It is hardly surprising that the students will learn less well when the visuals are arranged in an unplanned random order. The use of superimposed materials resulted in more learning probably because of the greater amount of materials transmitted through the technique. What is noteworthy is the finding that the students learn more when the visual manipulation is carefully planned by both the television team and the studio teacher. This suggests the importance of coordination.

11. ATTENTION-GAINING CUES THAT ARE IRRELEVANT TO THE SUBJECT MATTER WILL MOST PROBABLY HAVE A NEGATIVE EFFECT ON LEARNING FROM INSTRUCTIONAL TELEVISION.

Sometimes, films and particularly commercials use attention-gaining cues which are quite irrelevant to the subject matter. Would the use of such cues aid or distract from learning from instructional television?

Neu (1951) tested this possibility by comparing the straight-forward version of an instructional film, one that was unadorned with any of the attention-gaining devices, with four modified versions. The film was about measuring instruments used in machine shops for military trainees. One modified version had relevant visual devices, such as extreme close-ups, finger pointing, and novel camera angles. The second version had irrelevant eye-catching cues such as a pretty girl. The third had relevant sound devices, like the noise heard in a machine shop. The fourth version had irrelevant sound devices, such as train whistles, pistol shots, and bursts of music.

Test results showed that the straightforward, unadorned version was the most efficient as an instrument of learning. The version with irrelevant sound effects was the least effective.

Harris and others (1962), experimenting with both film and television, also found results indicating that instructional presentation would be more effective by screening out irrelevant material.

It seems that for instructional purposes, little will be gained by the use of attention-catching cues even if they are relevant to the subject matter being taught. The use of irrelevant cues would most probably distract from learning.

B. Pedagogical variations

12. THERE IS NO CONSISTENT EVIDENCE TO SUGGEST THAT EITHER HUMOR OR ANIMATION SIGNIFICANTLY CONTRIBUTES TO LEARNING FROM INSTRUCTIONAL TELEVISION.

Many effective speakers can tell from their experience that a little humor, introduced at the right moment, will help regain the lost attention. Does humor help too in instructional television?

McIntyre (1954) attempted to answer this question. He designed an experiment in which a film with a humorous treatment was used to teach the proper use of cold weather uniforms to military trainees. A stupid character was shown to be making all kinds of mistakes, while an off-stage voice commented on and corrected them. Two modified versions of the same film were prepared. In one, the humorous portions were replaced with blank space, while a commentator supplied the information concerned. In the other version, printed titles and subheadings were used in place of the comic segments. The titled version was more effective than both the humorous version and the blank-space version, but no significant differences in learning resulted from the latter two.

In another experiment, Lumsdaine and Gladstone (1958) used humor in a film strip that taught phonetic alphabets to army trainees. The original version had humorous comments and cartoons. These were omitted in the modified version, where each letter was printed on a neutral background and pronounced by the narrator. The plain version yielded more learning than the humorous one, especially for low-ability trainees.

Similar to humor is the use of animation. In an experiment conducted by Lumsdaine, Sulzer, and Kopstein (1951), air force trainees viewed a film about the micrometer either in an animated version or in a nonanimated version. There were other variations, such as the effects of pretesting, number of examples of micrometer reading, and viewing of follow-up supplementary films. Regardless of these variations, the group that saw the animated film learned significantly more than the group that saw the nonanimated film. This was true for trainees of both above-average and below-average intelligence, although those in the lower and middle intelligence range seemed to have learned most from the animated film.

The effects of animation were also tested by Vestal (1952). Two versions of a film on electricity, one using animation, the other using direct photography, were shown to high school students. No significant overall differences in learning were found between the animated and the direct group. However, students in the upper quarter of ability learned significantly more from the direct photography version than from the animated version.

In a subsequent experiment reported by Fordham University (1953), naval trainees were shown either a direct, narrated film or an animated sound film. In this case, the direct narration was found superior to the animated sound presentation. When animation was combined with direct narration, the film was not as effective as direct narration only.

Perhaps the following tentative conclusion might be offered concerning humor and animation. It could be that in face-to-face teaching, an experienced lecturer will know when to use a little humor to wake up the audience and refocus their attention on the lecture. The television lecturer does not appear to have this advantage. Besides, humor could be quite distracting when used extensively, as in the few experiments we have cited, and therefore could even decrease rather than increase learning.

As to animation, it is obviously very difficult to generalize from the few experiments where the findings do not agree with each other. However, it seems that the effects of animation, if any, are not at all extensive. Perhaps it is only when the students are bored by an uninteresting lesson, something as dull as the reading of a micrometer, that animation will help break the monotony and improve learning. When animation does have any effects, it seems students of lower intelligence are more likely to benefit from it than students of higher intelligence.

13. SUBTITLES TEND TO IMPROVE LEARNING FROM INSTRUCTIONAL TELEVISION, PARTICULARLY WHEN THE ORIGINAL PROGRAM IS NOT WELL ORGANIZED.

We have already seen, in the experiment by McIntyre, that a film with printed subtitles resulted in more learning than the one without subtitles. However, findings from other experiments do not all agree with McIntyre's results.

One such experiment was conducted by Miller and Levine (1952). Various versions of a training film on Ohm's Law were shown to military trainees. One variation had to do with subtitles, the three versions being: no subtitles, major subtitles, and complete subtitles. No significant differences were found in learning among the three versions.

This experiment was later replicated by Miller, Levine, and Sternberg (1954). Although the major purpose of the replication was to test the effect of review, again no significant differences were found between the version with subtitles and the one without subtitles.

Not knowing the exact conditions under which the experiment by McIntyre and those by Miller and his associates took place, it is rather difficult to say why the results of these experiments do not agree with each other. However, another experiment, by Northrop (1952), may throw some light on the possible contribution of subtitles to learning from film and television.

Northrop showed three training films, chemical warfare, fire control, and survival, to naval recruits. Each film had three versions: the original one with no subtitles, a version with subtitles and an outline of the main points, and a version with subtitles, a main point outline, and subpoint outlines.

For the chemical warfare film, the one with titles and subpoint outlines was more effective than the one with titles and main point outlines, which in turn proved more effective than the original one without any subtitles. For the film on survival, the trend was in the same direction, although the differences did not reach a statistically significant level. For the fire control film, the differences were also not significant, but the original film without any titles yielded slightly better learning than the other two.

Northrop suggested that the film on chemical warfare was not inherently well organized, and therefore the use of titles and outlines would improve learning. If a film is highly organized, or simple in its structure, as Northrop thought to be the case of the fire control film, then the use of titles and outlines might interfere with the film itself and produce some negative effect on learning. Following Northrop, we would suggest that the different findings by McIntyre and Miller, *et al,* could be due to the possibility that one of the films was not so well organized while the other was.

Northrop further reported that most of the improved learning from the titled films came from recruits in the lower half of the intelligence grouping.

14. THERE IS INSUFFICIENT EVIDENCE TO SUGGEST THAT DRAMATIC PRESENTATION WILL RESULT IN MORE LEARNING THAN WILL EXPOSITORY PRESENTATION IN INSTRUCTIONAL TELEVISION.

When television or film is used for classroom instruction, one complaint sometimes heard from the students, particularly the younger ones, is that the presentation is dull. Could we make the presentation less boring by the use of dramatic rather than expository narration? Then perhaps we might be able to improve the amount of learning.

One of the few experiments that tested this possibility was conducted by Blain (1956). He showed a film on Monarch butterflies to both fifth-grade and eighth-grade children. Half of the children viewed the expository narration version, the other half, the dramatic narration version. For the fifth graders, no significant differences in learning were found between the two versions. On the whole, eighth-grade pupils learned more, and retained more than the fifth-grade children, as one might expect. Among the eighth graders themselves, the expository narration yielded significantly more learning than the dramatic narration.

Subsequent experiments, however, had varying results. Lumsdaine and Gladstone (1958) compared the expository version of a film, "Seasons," with a live-action dramatic dialogue version. The dramatic version retained all the verbal and pictorial contents of the expository version, except that three actors, a boy, a girl, and their father, played it out in a dialogue form.

Each version was known to randomly divided halves of fifth-grade and ninth-grade students. The fifth graders liked the dramatic version better, buth the ninth graders rated it lower than they did the expository version. Thus, dramatization seems to appeal to small children only. When the test scores were compared, only slight differences were found between the two versions, but in rather unexpected directions. For the fifth grade, the expository group did slightly better. For the ninth grade, the dramatic group scored slightly higher.

In a more recent experiment, Kazem (1961) compared four groups of high school students. One saw two expository films on science. One saw two dramatic versions of the same film of each category. The other group did not see any films. Test results showed that all the three film groups scored significantly higher than the no-film control group, but there were no significant differences among any of three experimental groups.

Although these experiments had varying results, it may be noted that the only significant difference was in favor of expository narration for the eigth-grade subjects of Blain. Two earlier experiments conducted among military trainees yielded similar results, although in these cases dramatization was not experimentally controlled. In one experiment, Rock, Duva, and Murray (1951a) divided 360 naval recruits into three groups: live TV, kinescope, and face-to-face instruction. They found direct narration by the TV instructor to be an effective means of teaching. When the content of the program was further analyzed, they found that television instruction tended to be superior to face-to-face teaching when the TV instructor talked directly to the students without dramatization. A combination of dramatic action and narration was found ineffective. In another experiment by the same authors (Rock, Duva, and Murray, 1951b), it was found that army reservists taught by direct narration seemed to learn and retain more than those taught by dramatization.

From these experiments, it seems that the use of dramatization does not have any clear advantage over the simple, straightforward expository presentation. Small children may like the dramatic presentation better, but they seem to learn less well from it, perhaps because the dramatization distracts their attention from the points to be tested. For older students, the findings are not quite so clear because the findings reported by Lumsdaine do not agree with the others. But one thing appears obvious: We do not have enough evidence about the merits of dramatization to say that it will necessarily accomplish more than an expository presentation of equal quality. It hardly needs saying that the relative quality of these two types of performance are not easy to measure apart for their effects on attitude and learning, and that the tests of learning are generally of simple and basic points and usually do not try to find what kinds of information – beyond these basic learning objectives – might be derived uniquely from the two forms of presentation.

15. INSERTING QUESTIONS IN A TELEVISION PROGRAM DOES NOT SEEM TO IMPROVE LEARNING, BUT GIVING THE STUDENTS A REST PAUSE DOES.

Another pedagogical device that may help focus the student's attention is to insert questions into the televised instruction. It can be argued that when faced with specific questions, the students probably will not only pay closer attention but also will know what specific points they should learn. But will they? Several experiments sought an answer to this question.

May and Lumsdaine (1958) compared the original version of a film on "The Heart and Circulation of the Blood" with three modified versions. One had questions inserted before the presentation of the relevant information, such as "Do you know that . . . ?" Another version asked questions after the information had been presented. The film was then stopped and the students answered the questions on prepared sheets. The third modified version had both. The films were shown to tenth- and eleventh-grade students.

When pretest scores were compared with posttest scores, the original version produced a gain of 8.2 per cent in correct answers. For the three modified versions, the gain scores were 10.5 per cent for the one with preceding questions, 12.2 per cent for the one with questions and answers, and 14.0 per cent for the one that had both. Because the latter two versions also involved practice, the only comparison should be between the original and the one with preceding questions if we want to assess the effects of inserted questions on learning. In this case, the difference was only 2.3 per cent.

Later, Kantor (1960) designed an experiment in which the practice factor was eliminated. He had three versions of a film on sunfish, shown to seventh-grade pupils. The original version had no inserted questions. In one modified version, the questions were inserted before, in the other version after, the content was presented. No significant differences were found among the three versions for either immediate or delayed posttests.

Vuke (1963) prepared two versions of a short film on a science experiment for seventh-grade students. One version had 18 questions, the other none. No significant differences were found between the two versions for either immediate or delayed posttests. When the scores were further analyzed by ability level, still no differences were found between the two versions, although in each group the higher ability students learned significantly more than the lower ability students.

From these experimental findings, it seems that a gain in learning from questions inserted in the instructional film or television is not proven. Although May and Lumsdaine reported some small gain, the two subsequent experiments designed to test the effects of inserted questions both found no differences.

In fact, the results of serveral other experiments have cast considerable doubt as to whether the small gain found by May and Lumsdaine might not be due to the fact that the insertion of questions gave the students a little rest break.

McGuire (1961) tested this possibility by comparing blank rest pauses with pauses filled with statements like "try hard to memorize and get a good score." He used nine slides about an automobile fuel pump. The original version had no pauses. One version had a pause after the third and the sixth slide. In the other version, these pauses were filled with the motivating statements. Half of the students viewed the slides at a fast pace, that is, one every two seconds; the other half, at a slow pace, that is, one every four seconds. Although for the fast pace the statement version had the best results and the no-pause group did the least well, for the slow pace no differences were found between the pause and the statement version. Both, however, were better than no pause.

That pauses during an instructional television program would yield better learning seems clear from another experiment, by Pockrass (1961). He had college students matched for subject interest and academic record, and randomly divided them into four groups, to view two half-hour television programs. One group watched the programs continuously. For the remaining three groups, one had a one-minute rest break in between, another received unrelated verbal announcements during the one-minute break, the third heard a one-minute musical selection at the halfway point. The three groups that had the one-minute break all did significantly better than the one that saw the programs continuously. The differences were largely attributable to higher scores on post-break content questions. Students in the no-break group tended to consider the programs too long and showed loss of interest.

If we can generalize anything from these experiments, it seems that the effects of inserted questions for improving learning from instructional television are very limited, if any. We are not quite sure whether the little improvement in learning results from the motivating or attention-focusing effects of the inserted questions, or from the rest pause provided during the interval when the film is stopped and the question appears on the screen. On the other hand, it seems quite clear that rest pauses will improve learning, particularly when the program is relatively long.

16. WHETHER A TELEVISION PROGRAM IS USED TO BEGIN OR TO END A DAILY LESSON BY THE CLASSROOM TEACHER MAKES NO DIFFERENCE IN LEARNING.

As we have mentioned earlier, practically nowhere in the world is television meant to be used as the only teaching instrument in the classroom. Normally it is employed as part of a lesson. One of the questions that emerges is: Would the television instruction be better used as the initial segment of the lesson, or as the final segment?

A number of experiments, all using the same sample of fifth-grade children in Massachusetts, tested this possibility. The designs of these experiments were all the same: 72 classes randomly assigned to 24 experimental conditions involving training of the teacher, use of study guides by the teacher, class assignments vs. individual projects for the students, and television as the initial or the final segment of the daily lesson. All groups received the same 30 lessons on natural science. The experiments differed only in the dependent variables, that is, the main effects.

In the experiment by Kraft (1961), the question is: Do all these variations, including the one concerning the initial or final segment, make any difference to the amount of information and science vocabulary learned?

On the vocabulary tests, no significant differences were found between any of these experimental conditions or combinations. For the science information tests, those classes that received television instruction as the final segment of their daily lesson did better when they had class assignments, while those classes that received television instruction as the initial segment did better when they had individual project assignments. But no significant differences were found between the initial and final segment groups in general.

In the second experiment, by Sheehan (1961), the main effects examined are interest in science and attitudes toward science and scientists. Again, the findings indicated that it would make no difference whether the television instruction comes as the initial or final segment of the lesson.

In the experiment by Dietmeier (1962), still using the same children and the same design, the purpose was to see whether these variations would make any difference to the students' ability in scientific reasoning. No significant differences in science reasoning scores were found for any of the experimental conditions.

The last experiment (Amirian, 1963) had to do with retention. The same children were tested, half of them four months after they received the 30 television lectures, the other half eight months afterwards. Learning as measured by information or vocabulary tests in earlier studies was retained and increased four and eight months later. But there were no significant differences between those groups that used television to begin, and those that used it to end their daily lessons.

These experiments, being part of an overall design, illustrate rather conclusively that it makes no difference whether we use television to begin or to end a daily lesson as far as learning and interest in the subject matter are concerned.

17. REPEATED SHOWINGS OF A TELEVISION PROGRAM WILL RESULT IN MORE LEARNING, UP TO A POINT. BUT TEACHER-DIRECTED FOLLOW-UP, WHERE AVAILABLE, IS MORE EFFECTIVE THAN A SECOND SHOWING OF THE SAME PROGRAM.

Once a film or television program is produced, it can be shown over and over again without much additional cost. This would make it possible for the students to view the same program twice, three times, or more, until they have learned the material sufficiently well.

Several questions need to be answered however. Would a reshowing of the same program actually improve learning, and if so, how much? Would the students be able to keep up the rate of improvement if they view the same program more than twice, say three times or more? Or would there be a diminishing return after a certain point? A fairly large number of experiments have tested the effects of repeated showing of the same program, but here we shall report on only a few.

In the experiment by May and Lumsdaine (1958) mentioned earlier, where the major purpose was to test the effects of inserted questions, it was found that showing the original film twice was able to bring about a gain of 12 per cent, as compared with a gain of 8.2 per cent from a single showing. If we take the original gain as a basis, a second showing increased the original gain nearly by half.

Similar findings are reported by others. For instance, Driscoll (n.d.), working with retarded children, found that those who saw an instructional film twice learned significantly more than those who saw it only once. Hirsch (1953) compared several methods of teaching naval recruits by film, and found the most effective one involved showing the film a second time. A repeat showing not only decreased forgetting but also made new learning possible. Ketcham and Heath (1963) compared college students who saw a film about William Wordsworth only once with those who saw it three times. He found the latter learned significantly more.

Many more studies can be cited where the same general finding holds, namely, a repeat showing of the same program will improve learning. The question that remains is one of cost. That is, does the additional learning warrant the extra amount of time required for repeated viewings?

First, it must be quite obvious that repeated showing will have a diminishing return after a certain point. For instance, Ash and Jaspen (1953b) showed a film on the assembly of anti-aircraft gun breech-block to naval recruits either at a slow pace or at a rapid pace. They found that for the slow pace, a significant gain in learning was obtained only after the second showing. The third showing had little effect. With the fast-paced film three showings were necessary for a significant increase in learning, whereas the second showing had only slightly better results. Assuming most instructional programs proceed at a pace approximating the one Ash and Jaspen called "slow," there is probably no point in showing a film or television program more than twice.

But even with a second showing, the cost problem still is unresolved. For instance, in the experiment by May and Lumsdaine (1958), a 50 per cent increase in learning was achieved at the cost of 100 per cent increase in time. Similarly, Jaspen (1950) found that naval recruits who saw two demonstrations of a breech-block assembly had a median assembly test time of 150 seconds, while those who saw four demonstrations were able to achieve a median assembly test time of 102 seconds. Again, a 50 per cent increase in learning efficiency was obtained at the cost of twice as much the time spent. This question of learning improvement vs. time spent, then, depends on whether the increased learning is judged to be worthwhile. Here we merely want to point out the relativeness of the effects of repeated showing.

The practical question is perhaps not whether repeated showing is worth the cost of additional time. It is rather: If improved learning is desired, is there any better way to achieve it? If not, then a repeated showing would be the only alternative left under the circumstances.

This question is answered in part by experiments conducted during an extensive instructional television project in Denver. The project involved 6,000 pupils in 192 Denver schools. The subject matter taught by television was Spanish. We shall have occasion to refer to the Denver project later in this report. Here we shall only cite the findings concerning repeated showing.

In the first experiment (Hayman and Johnson, 1963a), all pupils were divided into three groups. All received the television instruction. One group saw the programs only once, each lasting 15 minutes; one received a repeat showing in the evening; the third group had a 15-minute teacher-directed follow-up instead of a second showing. After one semester, test results showed that the teacher-directed follow-up group scored significantly higher than the repeat-showing group, which in turn scored significantly higher than the non-repetition group.

In the second semester, the non-repetition group was given both a second showing and teacher-directed follow-up. For the other two groups, the treatments were the same as in the first semester. Both the teacher-directed follow-up and the teacher-directed follow-up plus second showing resulted in significantly more learning than second showing only, but no significant differences were found between the former two.

This part of the experiment was replicated in the following year by comparing teacher-directed follow-up with teacher-directed follow-up plus evening reshowing. This time, the group that had the evening repeat showing scored significantly higher in oral tests.

The authors also reported that exact repetition by a second showing was more effective for classes having inadequately trained teachers than for classes having adequately trained teachers.

These experiments show several things: If teacher-directed follow-up is available, the time would be better utilized by giving the students a follow-up by their own teacher, rather than a second showing of the television program. If teacher-directed follow-up is not feasible, then a second showing would be the only thing we can do if we want to improve learning. This would be the situation in countries where well-trained teachers are in short supply. In this case, a repeat showing is capable of making up for some of the inadequacies of the teacher.

18. IF SAVING TIME IS IMPORTANT, A TELEVISION PROGRAM CAN PROBABLY BE SHORTENED AND STILL ACHIEVE THE MINIMUM REQUIREMENT OF TEACHING.

We have seen that a second showing of a film or television program can result in more learning at the cost of doubling the time. This would be worthwhile if we are concerned more with improving learning than with saving time. Sometimes the reverse is true. For instance, in military training, time can be an important element. Can we save some time by reducing the length of a television program and still achieve the minimum amount of learning required?

This possibility was tested by Kanner, Mindak, and Katz (1958). First they developed a 38-hour army training program taught both by conventional instruction and by television. From this version they developed a shortened, 16-hour television program. Comparisons were made among the three methods. They found that learning and retention from the 38-hour conventional or television instruction were superior to those achieved from the shortened, 16-hour television instruction. What is noteworthy is the finding that no significant differences were found in the number of trainees failing to complete the course, whether they received 38 or 16 hours of instruction. Using course completion as the criterion, the authors concluded that the shortened television program resulted in important savings in training time and costs.

19. THERE IS NO CLEAR EVIDENCE TO SUGGEST WHETHER EYE-CONTACT IN TELEVISION INSTRUCTION WILL AFFECT THE AMOUNT OF LEARNING.

In teaching a class, the instructor can either look at the students or not look at the students. This is referred to as eye-contact. It is generally assumed that the attention of the students will be closer if the teacher looks at them most of the time. In television teaching, looking at the students means looking at the camera lens. Would it make any difference whether or not the television instructor keeps his eyes on the camera most of the time?

An experiment by Westley and Mobius (1960) investigated this problem. They randomly assigned 51 paid female college students to three groups. Three television lectures on computer applications were prepared, each one under three eye-contact conditions. In the high eye-contact condition, the speaker looked at the camera lens 90 per cent of the time. This was reduced to 40-60 per cent for medium eye-contact, and 10 per cent for low eye-contact. Each group saw three different lectures having different levels of eye-contact on three consecutive nights.

While the students were viewing the program, pictures were secretly taken of them at one-minute intervals to provide a group attention score. After the picture was taken, a bell rang and the students indicated their interest at that point on a seven-point scale. The students also took an information test after the program.

Analysis of the data showed no significant differences either in attention, interest, or learning that could be attributable to eye-contact manipulation.

However, it is difficult to generalize from one experiment. At least two conditions could conceivably render the learning environment in this experiment not comparable to what one would usually find in a classroom. First, the college girls who served as subjects were paid. Their motivation would probably be different from that of the ordinary students in a classroom, and we do not know to what extent the monetary reward would affect their level of attention, which is the main variable under experimentation. Secondly, it may be recalled that a bell rang once every little while and the students were required to mark their interest on a seven-point scale. Again we do not know to what extent this procedure might distract the subjects' attention and confound the experimental results.

The effects of eye-contact on students' attention and learning were also examined by Connolly (1962), although some other uncontrolled factors seemed to have entered this experiment. Connolly used college freshmen who had failed the English placement examination as his subjects. They were randomly divided into two experimental groups and one control group. The two experimental groups attended a television lecture once a week as part of the course requirement. In addition, both had work sessions with graduate students in English. In one experimental group, the students received eye-contact from the television teacher. In the other experimental group, the students did not receive eye-contact. Control-group students had no television lectures.

Test results showed the two experimental groups both to be superior to the control group, but no significant differences were found between the two experimental groups either in attention or learning. The same results were obtained when the experiment was repeated with the same students but with new content.

Two factors would seem to limit the generalizability of Connolly's findings. First, the fact that the subjects had failed the English placement test might have sufficiently motivated them to pay attention to the television lectures whether or not the teacher gave them eye-contact. Secondly, since the students also had work sessions with graduate students in English, we do not know to what extent these work sessions might have confounded or reduced the difference in learning that may result from eye-contact.

One thing is in common about these two experiments, namely, the subjects were both college students, who were probably accustomed to focusing their attention on a lecturer when they were expected to. If so, the effects of no eye-contact would not have been pronounced. The results might be different if we had lower-grade primary school pupils.

In short, until further research findings are available, we shall not be able to say whether eye-contact in television instruction would significantly affect the amount of learning.

20. PROBLEM-SOLVING INSTRUCTION ON TELEVISION IS MORE EFFECTIVE THAN LECTURING WHERE THE MATERIALS TAUGHT INVOLVE THE SOLVING OF A PROBLEM.

The conventional way of presenting a lecture is by presenting relevant information about certain subject matter. Most teaching is done in this manner. Sometimes, the subject matter is of a nature of "what shall we do in case . . . ?" This would make it possible for the instructor to pose a problem, offer a number of possible tentative solutions, and then present evidence to support one of the proposed solutions. This is generally referred to as the problem-solving method. We shall report on two studies that compared the problem-solving method with the conventional method in television teaching.

In one experiment, by Dietmeier, Sheehan, and Decker (1963), two series of 20 half-hour television programs on natural science were shown to two groups of fifth-grade children. One series used the usual, information-giving method; one used the problem-solving method. For each group, six classes had teachers trained in the use of informational materials, six classes had teachers trained in the use of problem-solving materials, and six classes had teachers with no special training.

Tests of science reasoning, science information, and science concept, given both immediately after the series and four months later, found no significant differences for any of the experimental treatments.

In a separate experiment, Kaplan (1963) prepared two series of eight half-hour television lessons on health education, one using the conventional information-giving method, the other using problem-solving method. The programs were shown to two groups of randomly divided college freshmen.

Unlike Dietmeier, *et al,* Kaplan used both a multiple-choice information test and a subjective problem-solving test. No significant differences were found between the two groups on the multiple-choice test. But on the problem-solving test, the group that received the problem-solving lessons did significantly better.

It seems that the failure of Dietmeier, *et al,* to find significant differences between the two methods could be due to the use of test instruments that were not particularly suited to reflect the merits of problem-solving instruction. The findings by Kaplan would suggest that the problem-solving instruction would be more effective than the conventional information-giving instruction in televised teaching where the subject matter taught concerns the solving of a problem.

21. THE STUDENTS ARE LIKELY TO ACQUIRE THE SAME AMOUNT OF LEARNING FROM INSTRUCTIONAL TELEVISION WHETHER THE MATERIALS ARE PRESENTED AS A LECTURE, OR IN AN INTERVIEW, OR IN A PANEL DISCUSSION.

The use of television also makes it possible to present a lecture in a variety of ways. For instance, the lecturer can pose as an expert being interviewed. Or, also as an expert, he can participate in a panel discussion with another expert. Would these forms of presentation result in more learning than the straight-forward lecturing?

Brandon (1956) tested this possibility. He had three speakers, each presenting one of three different topics in three formats: as a lecturer, as an expert being interviewed, and as a panelist in a discussion with another panelist and a moderator. From the nine 10-minute segments, 18 half-hour television programs were prepared, each featuring three speakers and three formats in different combinations. These programs were shown to college students.

In the course of the whole experiment, the interview and discussion formats were found consistently more interesting to the students than the lecture presentation. However, no significant differences were found in the amount of information learned from any of the presentation formats.

Thus it seems that the formats of presentation make little difference to the amount of learning from instructional television, although interview and discussion tend to be more interesting.

C. Viewing conditions

22. WHERE ACCURATE PERCEPTION OF IMAGES IS AN IMPORTANT PART OF LEARNING, WIDE VIEWING ANGLE AND LONG DISTANCE WILL INTERFERE WITH LEARNING FROM INSTRUCTIONAL TELEVISION.

Images on television differ from real objects in many aspects, one of which has to do with dimensions. Because the television screen lacks a third dimension, the images appear slanted to students sitting at a wide angle. This inability to view the images properly could conceivably interfere with learning from television. Thus we wonder whether the viewing angle will affect learning, and, if so, what would be the optimum angle of viewing. Similarly, we would like to know the effect of viewing distance on learning.

Ash and Jaspen (1953a) designed an experiment to test the effects of angle and distance when viewing a film, but the conditions should hold for television because they used a small screeen of 13 by 18 inches. They had 50 seating positions within a pie-shaped sector equivalent to one-sixth of a circle. The film was about the assembly of an anti-aircraft gun breech-block, shown to randomly assigned naval trainees. Learning was tested by assembly performance.

The authors found a downward trend for correct assembly as the viewers sat at a wider angle and farther away from the screen. The optimum area for viewing was a cone of 60^{0} wide and 18 feet deep, which is 12 screen widths. Those sitting outside this area performed significantly less well than those who sat within this area.

Kasten (1960) showed 252 television displays to college students to study the effects of angle on vision. He found that a viewing angle up to 19^{0} on either side did not reduce the accuracy of perception. This would mean a cone of about 40^{0} wide.

An experiment by Hayman (1963) suggests that the location of viewing would affect not only the learning of manual skills, such as the assembly of breech-block, but also the learning of speech. He compared the test results of fourth-grade pupils after they had watched three television lessons on Spanish. No differences were found on the listening comprehension test for children sitting in the center portion, the far-back portion, or the side portions of the room. But on the speaking test, pupils in the center and the back scored significantly higher than pupils on the sides, who sat at an angle of more than 40^{0}.

A problem related to viewing angle concerns the position of visuals: Does it make any difference to perception and learning if a visual is shown to the right and left of a central fixation point? Terrace (1959) investigated this problem by projecting 40 words and 40 unfamiliar nonsensical forms from a tachistoscope. A fixation point was placed on a screen 9 feet 10 inches from the subject's eyes. Half of the words and forms appeared to the right and half to the left of the fixation point. He found mean recognition scores were significantly higher for words in the right visual field than in the left visual field. No significant differences were found for the nonsensical forms.

However, not all experiments on seating locations found significant differences. For instance, Carpenter and Greenhill (1958) reported no significant differences in test scores between college students in a television psychology course who sat either closer or farther than 12 screen widths. Tendam (1961) let college students view a film on physics demonstration in a large 280-seat room. He found no significant differences in test scores between students sitting in the front half or rear half of the large room.

What these experiments indicate is that whether viewing angle and viewing distance would affect learning depends on other conditions. There is no apparent reason to expect any difference to result from either viewing angle or viewing distance if the learning does not depend on clear perception of images. This is what Hayman found in his listening comprehension test. In a course like psychology, where the perception of images does not often seem to be highly relevant, it is not surprising that no significant difference in learning was found between those sitting within and those sitting beyond the optimum distance of 12 screen widths. The lack of significant difference reported by Tendam is probably due to the large film screen and large room he used. This would make the viewing conditions not comparable to the conditions for viewing television.

On the other hand, where clear perception of images is an important part of learning, then both the angle and distance of viewing will become relevant. The findings by Kasten have clearly shown that a wide viewing angle would reduce the accuracy of perception. The experiment by Ash and Jaspen has illustrated the importance of accurate perception in learning manual skills. The finding by Hayman that pupils sitting at an angle of more than 40° did less well in the speaking test would indicate that even in learning to speak a foreign language, it may be important to watch carefully the lip and tongue configurations of the teacher. Children sitting in the side portions probably did not see the lip and tongue configurations as clearly as those sitting in the middle portion.

23. ADEQUATE ATTENTION PROVIDED BY THE CLASSROOM TEACHER WILL, IN MOST CASES AT LEAST, REMEDY THE ADVERSE EFFECT DUE TO A WIDE VIEWING ANGLE.

The adverse effect of a wide viewing angle on learning, generally known as the "cone effect," has been discussed in terms of the sharpness of the visual image. Gibson (1947), one of the first experimenters to investigate this effect, called it a problem of visual acuity. The general assumption of the visual acuity experiments has been that, because the students sitting outside an optimal cone cannot see the image clearly, they will not learn the material as well as those sitting inside the cone will.

However, the stimuli from the film or television screen are not the only important elements in a classroom learning situation. Usually, the classroom teacher will be present, and will play a role that contributes to the students' learning. It is quite possible, as Mayers (1967) has pointed out, that students sitting outside the optimal cone learn less well not only because they cannot see the images clearly, but also because they may be receiving less attention from the classroom teacher. If attention by the classroom teacher is an essential part of the learning situation, for instance, by encouraging the students to respond or participate, then inadequate attention given to students sitting outside the optimal cone would conceivably result in less learning.

Mayers designed an experiment to test this possibility. He used television to teach fifth-grade children to speak Spanish. In eight of the classes, the teachers encouraged the less responsive pupils to participate actively and respond to the television instructor. In the other six classes, the teachers merely acted as models for the class, responding to the television teacher as the pupils were supposed to do, but giving no special attention to the less-responsive pupils.

In those classes where the teachers did not pay any special attention to the less-responsive pupils, the same cone effect was found. That is, those children sitting inside the optimal cone had higher scores in the speaking test than those sitting outside the cone. In those classes where the teachers encouraged the less-responsive pupils to participate, the reverse was true. That is, those children sitting outside the cone had higher scores in the speaking test than those sitting inside the cone.

The findings by Mayers would suggest that the adverse cone effect could be remedied if the classroom teacher could give adequate attention to those sitting outside the cone.

24. NOISE WILL REDUCE THE EFFECTIVENESS OF LEARNING FROM FILM AND TELEVISION SO FAR AS PART OF THE LEARNING COMES FROM THE AUDITORY MEDIUM.

The use of instructional television and film does not always take place under perfect mechanical conditions. Sometimes, particularly in developing countries, the reception is poor, resulting in either blurred images or noise. We have already discussed the importance of clear perception of images to learning from television and film. What would be the effects of noise upon learning?

McGrane and Baron (1959) designed an experiment to answer this question. They presented three films about electricity to six groups of students. Three groups saw the films about electricity to six groups of students. Three groups saw the films from a projector, and the other three saw the films on television. The film groups saw the films with different ambient noise levels from the projector. In the TV groups, the noise level was constant and low.

Test results showed that the low-noise film group learned significantly more than the medium and high-noise film groups. At the low-noise level, the film group was superior to the TV groups. At the medium-noise level, no difference was found in learning between film and television presentations. When the noise level of the projector was high, the film resulted in less learning than television.

The authors suggested that ambient noise interferes with understanding the sound portion of the instructional films, thus resulting in loss of learning.

The effects of noise on learning were also tested by Miller (1952). He presented three learning tasks to Air Force ROTC cadets: memorizing nonsensical syllables, reading 15 statements, and learning to operate dial-setting.

Half of the cadets performed the learning tasks under quiet conditions, the other half under an almost deafening noise of the jet engine type. All subjects then saw an irrelevant motion picture before taking a test. The results showed no significant differences in learning between the quiet and noise conditions. Reactions of the cadets indicated that they graudally adjusted to the noise.

Although the experiment by Miller does not involve learning from film or television, the findings do not suggest that where the learning task does not depend on the auditory medium, noise will not reduce the effectiveness of learning.

25. INSTRUCTIONAL TELEVISION APPEARS TO BE EQUALLY EFFECTIVE WITH SMALL AND LARGE VIEWING GROUPS.

A problem of considerable practical importance has to do with the size of the viewing group. Would instructional television be equally effective with small as well as large classes? As we have mentioned before, a major contribution of instructional television is to make up for teacher shortage in developing countries, where the classes are apt to be quite large. Thus it would be desirable to know whether television can teach large classes as well as it does small classes.

On this point, the research findings tend to agree. Capraro (1957) randomly divided 369 air force cadets into groups of varying sizes from 19 to 110. The subject taught by television was air science. He found no significant differences between the various group sizes.

Carpenter and Greenhill (1958), using college students as subjects, varied the size of the TV classes from 11 to 119. Analysis of the test scores indicated no significant differences.

Driscoll (1959) used television to teach introduction to education to college students. He divided 147 students into two viewing rooms, one seating 24 and the other 123 students. No significant differences were found in test performance for the large and small TV classes.

Neale (1961) also found no significant differences in learning by college students who observed televised classroom teaching either in small or in large groups.

These experimental findings indicate that television can effectively teach classes as large as 100 students or more. However, this conclusion needs to be qualified by the fact that in all these experiments, the subjects were students at the college level. We shall need further research evidence from younger children, particularly those at the lower grades in elementary school, where large classes are perhaps more likely to mean poor discipline and poor attention. Furthermore, viewing angle and distance from the screen must be taken into account, as we have previously pointed out.

26. INSTRUCTIONAL TELEVISION MAY OR MAY NOT BE MORE EFFECTIVE WITH HOMOGENEOUSLY GROUPED STUDENTS, DEPENDING ON OTHER FACTORS IN THE LEARNING SITUATION.

Teaching a higher heterogeneous group seems to be a difficult task. This difficulty would seem to be further aggravated in televised teaching where the instructor is even less able than the classroom teacher to meet the varying needs of the students. Thus, intuitively, it would seem that if homogeneous grouping is worth considering for classroom teaching, it should be even more so for televised teaching. However, the scanty research findings do not provide clear evidence to support our intuition.

We shall cite three studies bearing on this problem. Jacobs, Bollenbacher, and Keiffer (1961) used television to teach mathematics to seventh-grade students who were about two years behind in their achievement. The students were homogeneously grouped. Based on comparisons with other experiments conducted in the same school system, the authors suggested that television instruction appears to be more effective with homogeneously grouped students than heterogeneously grouped students.

Berger (1962) presented eight self-contained television lessons on mathematics to ninth-grade students who were assigned to either homogeneous or heterogeneous groups according to their IQ scores. The high-ability students in homogeneous groups did significantly better in mathematics achievement than the high-ability students in heterogeneous groups on three lessons. But the low-ability students in homogeneous groups did significantly less well than the low-ability students in heterogeneous groups on one lesson.

In an experiment conducted by Duke (1960), college students in a televised economics course were randomly assigned to various treatments including homogeneous vs. heterogeneous grouping, independent study, and additional advanced reading. All students watched 30-minute television lessons followed by 20-minute discussion. No differences were found between the homogeneous and heterogeneous groups for either the high-ability or low-ability students. In fact, none of the treatments yielded any significant differences.

These experiments suggest that televised teaching may or may not be more effective with homogeneously grouped students depending on a number of factors which are not yet quite clear. For one thing, the advantage of homogeneous grouping in televised teaching may be of a different nature from the one in classroom teaching. In classroom teaching, a homogeneous group would enable the teacher to choose a level that would be best for almost all students in the class. For homogeneous groups of different ability levels, the face-to-face instruction will differ either in the materials being covered, or in the pace of teaching, or both. For televised teaching, this is not so. As in the experiment by Berger, the same television lessons were given regardless of the ability of the student or the homogeneity of the class. Since the instruction does not differ, the advantage of homogeneous grouping, if any, must lie elsewhere unless the entire viewing audience is grouped homogeneously according to ability, and the television is designed to fit that ability level. In this sense, we suggest that the main advantage depends on the different responses the students will make in homogeneous and heterogeneous classes.

For high-ability students, being in a homogeneously grouped class would mean competition and exchange of help with other students of equally high ability. Thus we would expect the high-ability students in a homogeneous class to do better than high-ability students in a homogeneously grouped class. On the other hand, for low-ability students, the presence of high-ability students in a heterogeneously grouped class would mean greater stimulation and some help, provided the lectures are not too much over their head. The low-ability students in a homogeneous class would not have such benefits. Thus we would expect the low-ability students in a heterogeneous class to do better than the low-ability students in a homogeneous class. This is essentially what Berger found.

The experiment by Jacobs, Bollenbacher, and Keiffer, by presenting a series of lectures to suit the needs of low-achieving, homogeneously grouped students, more or less approximates the conditions of homogeneous grouping in face-to-face teaching. It is therefore hardly surprising that these students did better than heterogeneously grouped students in some other experiments in the same school system.

The lack of any significant differences reported by Duke is a little puzzling. It may be noted that some of the high-ability college students were excused from class attendance to take on independent study halfway through the course, while other high-ability students were given additional advanced reading in addition to viewing the televised lectures in a homogeneous group. Yet no differences were found between these groups and others of high and low ability who were in either homogeneous or heterogeneous groups. Without knowing more about the contents of the lectures and the substance of independent study as well as additional reading, it is rather difficult to comment on Duke's findings. Probably the achievement scores had little to do with either homogeneity of the group or with any of the experimental treatments.

Even though the discussion above seems consistent with the findings by Berger, and by Jacobs, Bollenbacher, and Keiffer, it must be stressed that further research is needed before we can say the advantage of homogeneous grouping in televised teaching is due to different response patterns by the students.

27. WHETHER INSTRUCTIONAL TELEVISION CAN TEACH STUDENTS WHO VIEW AT HOME AS EFFECTIVELY AS STUDENTS IN THE CLASSROOM SEEMS TO DEPEND ON OTHER CONDITIONS.

Typically, instructional television is used to teach students in a classroom, but sometimes the need arises for reaching students at home via television. For instance, Castle (1963) used open-circuit educational television to present a lecture on diabetes mellitus to physicians viewing at home. Also, Stromberg (1952) offered a course in introductory psychology via open-circuit television to adult students who viewed in their homes. Another example of home viewing is the Chicago TV College (Erickson and Chausow, 1960), where students could stay home and earn credit for regular college courses.

Can television teach as effectively when the student views at home as it does when the student is sitting in the classroom? A number of experiments have looked into the question, but come up with varying results. We shall first present their findings, and then discuss the implications.

Abbey, *et al* (1963), assigned 120 nurses either to group viewing in a hospital or to individual viewing in their homes. Altogether six programs on nursing care of the aged were presented. Those nurses who viewed at home had significantly higher achievement scores than those who viewed as a group in their hospital.

Dreher and Beatty (1958) compared college students who received instruction by either on-campus television, or off-campus television, or face-to-face teaching. The courses taught were psychology, economics, and English. No significant differences were found among the three presentation methods for any of the courses.

Gordon, Nordquist, and Engar (1959) used television to teach the use of slide rule to college students. Some viewed the program on campus, other viewed off campus but with credit, and still others viewed off campus without credit. Although there was a tendency for the on-campus students to do better than the off-campus credit students, who in turn scored somewhat higher than did the off-campus noncredit students, the differences were not statistically significant.

Janes and McIntyre (1964) encouraged a total of 971 college students either to attend the television lectures in classrooms or to view the programs in their residence halls. About half of the students chose to view the telecasts in their residences. The authors reported that the choice seemed to be a matter of convenience, and that the place of viewing did not seem to have any practical effect upon the students' achievement or academic motivation.

In the Chicago TV College we have mentioned, comparisons were made among students taught face-to-face, students taught by classroom television, and students taught by television at home. Where significant differences were found, the TV-at-home students did better than the others.

In an experiment that tested both motivation and home vs. school viewing, Mullin (1956) divided eleventh-grade students into two groups. The motivated group had a promise of monetary reward; the unmotivated group received no such promise. Within each group half of the students viewed the program at home, and half in their classroom. The program was about explorations in space.

Tests given 24 hours after the television program and two weeks afterwards showed that the motivated group scored significantly higher for both tests. However, the mean scores suggest that the unmotivated viewers may learn more in the classroom, while the motivated viewers may learn more at home.

Before we discuss these varying results, we want to pause and ask a basic question: In what ways would viewing at home differ from viewing in school? How would such differences, if any, affect learning from television?

Learning, like any other behavior that is meaningful to the individual, is motivated, and one source of motivation seems to be social support. That is, a student is reinforced for engaging in certain behavior, which is not exactly exciting, by the fact that others are seen to be doing the same thing. Another source of motivation is competition, also facilitated by the knowledge that other students are engaged in the same game. These two sources of motivation could be weakened when the student views the television lecture alone at home.

Another factor which may enhance learning in a classroom is interaction between the students, by exchange of ideas. The student who views the program at home does not have this benefit. The classroom situation also provides supervision by the teacher or monitor, a factor likely to bring about more learning, particularly for young pupils.

These factors would seem to work against viewing at home. However, there are other factors that may be operating in favor of viewing at home. For instance, the students may feel they have been picked out as guinea pigs, and may react by working doubly hard, particularly if the program is of a short duration. This is generally known as the Hawthorne effect. Or the pressure for passing the course may be sufficiently great so that the students put in extra work to offset the disadvantage of viewing at home. Then, there is the possibility that those students who voluntarily enroll in home-TV courses may be different from the regular school students to begin with.

When we merely compare the home-viewing students with the classroom-viewing students, the factors we have discussed above may operate in different combinations depending on the experimental conditions, and we shall not be able to interpret the findings unless we know more closely what went on in the experiments.

In the absence of this knowledge, we can only speculate as to why the results from these experiments do not agree with each other. Take the experiment by Abbey, *et al.* Here we suspect the nurses assigned to view the programs at home probably felt that they had been singled out. It would not be surprising if they should have worked harder just to make sure that they would not fall behind their peers.

The results in favor of the home-TV students in the Chicago TV College are most probably due to the fact that those students who enroll in evening extension courses are highly motivated, and grateful to be able to take the courses which otherwise would be closed to them, and thus usually do well.

The finding by Janes and McIntyre seems to have possible explanations. If students chose to view the telecasts in their residence halls as a matter of convenience, they probably did not differ initially from the others who chose to view in the classroom. Besides, since the residence hall students and classroom students were both viewing the television lectures with other students anyway, there really was no difference in the viewing environments of the two groups. Supervision probably played an insignificant role for those college students.

The lack of significant differences reported by Dreher and Beatty could be due to the possibility that the off-campus television students were adjusting themselves to the necessity of passing the course.

The findings by Mullin are particularly interesting. We might speculate that when the students are not motivated by monetary reward, the classroom environment will provide considerable social support and interaction, which the home-viewing students lack. Thus the classroom-viewing group did better. On the other hand, under the motivated condition, the students viewing at home will tend to work hard to justify the reward, while for the classroom-viewing students, the presence of others may have created a group norm to prevent excessive striving. This could have resulted in favor of the home-viewing group.

However, even though the discussion above seems to make sense, we must point out that it is largely speculation. The question we should ask is not whether home viewing is more or less effective than school viewing. If there is no alternative to home viewing, such as the use of open-circuit television to teach a special audience, then the question is unrealistic. The real question is: If we must let the students view the program at home, to what extent will the lack of social support, the lack of competition, and the lack of interaction and supervision impair the amount of learning, and, if so, what can we do to make up for these possible shortcomings of home viewing? Would elementary school children be affected to the same extent as older students? We have as yet no clear answers to these questions.

28. AT THE COLLEGE LEVEL, PERMISSIVE ATTENDANCE DOES NOT SEEM, BY ITSELF, TO REDUCE THE EFFECTIVENESS OF INSTRUCTIONAL TELEVISION.

Somewhat related to motivated viewing is the question of an attendance requirement. Would it make any difference to learning from television if the students were told they would have a completely free choice whether or not to attend the telecast lectures? We shall report on two experiments, both by the same author and both using college students, that tested this possibility.

In the first experiment, Woodward (1965) told one section of a natural science class that attendance during that semester would be completely permissive and that there would be no administrative attendance report. This was the experimental group. Another section, which served as the control group, was told that it was under regular attendance regulations. Both received televised lectures.

Out of 39 possible nonrequired class periods for the experimental group, absenteeism ranged from 1 to 34, averaging 14.51 for the whole class. There was a significant negative relationship between the number of absences and test scores, that is, the more periods a student skipped, the lower his scores. However, the two groups did not differ in performance on the final grades.

In the second experiment, Woodward (1966) used four sections of a social science class as his subjects. Two sections were allowed permissive attendance, the other two under regular attendance. Essentially the same findings were obtained. The two groups did not differ either in unit examinations or in their final grades. In the permissive attendance group, students with the greatest number of absences received the lowest grades.

It may seem a little puzzling that while students with high absenteeism received poor grades in the permissive attendance group, no overall differences were found between permissive attendance and regular attendance. The second experiment provided data that threw some light on this question.

It was found that students with high absenteeism not only received poor grades for the current semester, but they also had poor grades in a previous course in social science when attendance was required. In fact, those students who had earned the poorest grades in the previous course had the greatest number of absences this time.

This would suggest that it is not absenteeism that causes low grades. It is the low-achieving students who took advantage of the permissive attendance. They would probably receive equally poor grades even if they were required to attend the classes.

Thus it seems that permissive attendance probably makes no difference to learning from instructional television. It must be pointed out, however, that both experiments were conducted with college students. The results could conceivably be different if the subjects were elementary school children – if that were realistic to test.

29. STUDENTS WILL LEARN MORE FROM INSTRUCTIONAL TELEVISION UNDER MOTIVATED CONDITIONS THAN UNDER UNMOTIVATED CONDITIONS.

Results from learning experiments, generally using learning situations of relatively short duration, have shown that students learn more when they are motivated than when unmotivated. Experiments using films or short television programs have yielded essentially the same findings. For instance, in the study by Mullin (1956) mentioned before, students receiving a promise of monetary reward learned more from a television program on space explorations than students not receiving such a promise. We shall report on a few more experiments to illustrate the effect of motivation arousal on learning from film and television.

Allison and Ash (1951) showed a film on introductory psychology to college students divided into three groups. Before seeing the film, one group received anxiety-relieving instructions, i.e., the film was easy, etc. Another group received instructions intended to arouse their anxiety, i.e., the film was difficult and if they did not learn the material well they did not belong in college. The third group received neutral instructions. A fourth group did not see the film, but took the same test as the others did. The total size of the four groups was 237.

Test results showed that students who received anxiety-producing instructions, and were presumably in a highly motivated state, had significantly higher learning scores than students who received neutral instructions. The latter in turn had higher scores than those who received anxiety-relieving instructions.

The experiment was replicated on 243 other students, using a different film about introductory psychology. The results were essentially the same.

Kimble (1961) designed an experiment to test the effects of praise and reproof on learning from two films about slide rule. The subjects, all Air Force basic trainees, first viewed a film on how to read the slide rule, and then took a test. Trainees in the praise group were told that most of them seemed to be doing well and that their performance was gratifying. For the reproof condition, the trainees were told they were doing poorly. In neither case was anything said about trying to do better. In the non-incentive condition, the trainees were told nothing. All trainees were then shown the second film, on how to use the slide rule to multiply and divide. This was followed by a final test which included the same 25 items on the first test plus 10 questions on the second film.

The analysis was based on results from the final test. On the 25 items covering the reading of the slide rule taught before the incentive treatment, no significant differences were found among the three conditions. On the 10 items about the use of the slide rule taught after the incentive treatment, significant differences were found. The group that received reproof did best, and the group that received no incentive did least well.

Gropper, *et al* (1961), showed six demonstrations on television about physical science to junior high school students. After the telecast, the students were asked which demonstration they would like to try at home. One-third of the students were given a kit for the demonstration they chose. One-third were given post cards to mail for their kits. The remaining one-third were told that if they mailed a post card of their own, they would get a kit. Test results showed that students given a kit or a post card had a significantly higher increase in science interest.

Another experiment bearing on the effect of motivation upon learning was reported by Greenhill and McNiven (1956). Senior students in a high school were asked to rank the usefulness of three films: first aid, atomic energy, and how a car functions. Then they were randomly assigned to view one of the three films, so that in each viewing group there were students who had ranked that film first, second, or third. This was referred to as psychological goal distance.

The group that saw the film on first aid was further divided into three subgroups. One subgroup was told that they would be expected to demonstrate their knowledge about first aid the next day. Another subgroup was told that there would be a test two months later. The third subgroup received no further instruction. This was referred to as temporal goal distance.

Test results showed that for all three films, those who ranked them first scored higher than those who ranked them second, who in turn scored higher than those who ranked them third. But no significant differences were found among the learning scores of the three temporal goal distance treatments.

These experiments, though varying in approach, all consistently showed that more learning will result from high motivation, whether the motivation comes from promised monetary reward, praise, reproof, or own initial preference. However, it is not quite clear how we can apply these findings to the actual situation of learning from instructional television, which involves not just one film or one program, but rather carries on for a whole semester, or a whole year. The promise of monetary reward would generally be out of the question. Nor could the students be allowed their own preference. The use of praise or reproof would usually have a diminishing return beyond a few applications.

Thus even though the research findings clearly point to the beneficial effects of motivation arousal upon learning from television, how to put these findings into practical use remains a problem.

One approach to increase the students' motivation to learn is the providing of immediate feedback, by letting the students know their progress and results of learning. Another approach is to get the students more deeply involved in the learning task by some kind of participation. These possibilities will be fully discussed in a later section of this chapter.

Here we shall discuss the social incentives as a motivational force. One finding reported by Hayman and Johnson (1963b) seems to provide a suggestive lead on the use of social support to motivate learning from television, although this was not the original purpose of their experiment. As part of an extensive study of instructional television conducted in Denver public schools, some parents were encouraged to learn the Spanish lessons from television with their children. It was found that children whose parents participated in the program learned more Spanish than those whose parents did not participate.

Now it could be, as the authors suggested, that these children learned more because they received help from their parents. But we should not overlook the possibility that having the parents join in the learning task could have provided enduring social support and motivation to the children as well. The findings from an experiment conducted in Taiwan (Chu, 1964) appear to be consistent with this interpretation. There it was found that children whose parents showed awareness of the experiment, and thus presumably more concern, learned more from television than others. It seems that the role of parental support in motivating learning from television could be an area of fruitful further research.

D. Lack of Two-Way Communication

Unlike classroom teaching, televised teaching is essentially a one-way communication. Sometimes the lectures are telecast from a studio where a small group of students may have some two-way communication with the television instructor. But the great majority of students are not in the studio. In fact, most of the time the studio is not equipped to accommodate students. In that case the only communication is the message coming from the instructor on the screen to the students sitting in their own classroom. This inherent limitation of instructional television may conceivably affect learning in several ways.

First, because the instructor is talking to a camera, not directly to his students, he will not be able to perceive the reactions of his audience. He would not be able to tell whether he is going too fast or too slow, where he should elaborate, or whether his lecture is getting through to the students at all.

From the student's viewpoint, learning from television means he is unable to raise questions, to ask for clarification, or to benefit from the free discussion with the instructor and other students. In other words, he is unable to benefit from certain important elements of classroom teaching.

If we regard learning as a continuous process of reinforcing the correct responses, evidently instructional television does not provide an ideal learning situation even though the student thinks he has no questions and needs no clarification. This is because the responses the student is making may not be correct. Inasmuch as feed-back to the television teacher is slow if not totally absent, these wrong responses may have been inadvertently reinforced before the teacher had a chance to correct them. This would make for inefficient learning.

Learning, like any other behavior, is motivated by incentives. One possible incentive for learning is emotional support which the student perceives from his teacher. In learning from television, the absence of personal contact with the instructor may reduce the amount of emotional support the student feels he is getting. We shall discuss research findings bearing on these problems. However, it may be noted that the boundary lines between these problems are not clearcut, and the interpretation of the research findings will not always be unambiguous.

30. LEARNING FROM TELEVISION BY THE STUDENTS DOES NOT SEEM NECESSARILY TO BE HANDICAPPED BY THE LACK OF PROMPT FEEDBACK TO THE INSTRUCTOR.

The importance of feedback to teachers has been long recognized. The Southwestern Signal Corps (1953) examined this problem in television teaching and came up with the suggestion that an in-studio class would be desirable from the instructor's viewpoint. Martin (1958) has recommended placing a camera in each classroom, right above the television receiver, which will send a picture of a class back to the television instructor. He believed the camera would create some notion of personal contact. Of course such a set-up can only work with live presentations.

In fact, something like that has been recently tried as a training device for beginning television teachers (Bretz, 1967). An eight-inch monitor was placed on the studio camera, through which the instructor could see four to eight of the students in one of the viewing classrooms. A small speaker provided some sound feedback from the classroom. This feedback system was found useful in the training of TV instructors.

But would the lack of student feedback to the TV instructor about his lecture impair the effectiveness of televised teaching? Wolgamuth (1961) conducted an experiment that bears upon this question. He divided 80 college students into four groups, each viewing a separate series. One group sat in the studio. Another group used a microphone feedback system by which the students could talk to the instructor. A third group had an electrical signal system by which the student could inform the instructor whether his pace is correct and whether the students wish an example or repetition of a point. The fourth group had no feedback system.

The students were pretested and posttested, immediately after a series of five lectures and again four weeks later. Data analysis indicated no significant differences in learning and retention among the four treatments. Nor were there any significant differences in the students' attitudes toward the course.

The effects of audience feedback were tested in another experiment (Johnson, 1960). Eight speakers, all faculty members having no prior experience in television speaking, were randomly assigned to two conditions. Four of the speakers each had 20 students with them in the studio to provide feedback during the instruction. The other four speakers were alone in the studio. Each speaker was provided an outline on listening skills, and allowed to develop his lecture in whatever manner considered appropriate. The subjects were college students in a speech class. Test results showed that student feedback did not appear to have a significant effect on communication; the two groups of students did equally well.

31. SHOWING, TESTING, REVISING AN INSTRUCTIONAL TELEVISION PROGRAM WILL HELP SUBSTITUTE FOR LACK OF LIVE FEEDBACK TO THE TEACHER, AND MAKE FOR MORE LEARNING BY THE STUDENTS.

Even though the experiments cited above indicate that the lack of feedback to the television instructor will not necessarily reduce the amount of learning, there is no denying that the instructor will be handicapped in the sense that he does not know the immediate reactions of his students. Gropper and his associates have suggested one way to minimize this handicap. Their solution is to show a TV program to a group of students, test their performance, and then, on the basis of performance, revise the telecast.

Gropper, Lumsdaine, and Shipman (1961) tried out this method on a group of junior high school students. Two lessons, on heat and introduction to chemistry, were telecast both in the preview versions and the revised versions. Test results showed that students watching the revised programs learned significantly more than those watching the preview programs. The authors concluded that preview testing is a satisfactory substitute for classroom interaction between the teacher and the students.

If one revision results in more learning, would a lecture twice revised be even more effective? This possibility was tested in another experiment by Gropper and Lumsdaine (1961b). A TV lesson on levers was first tried out with three students, and then revised. The revised version was subsequently revised a second time. In the experiment, only the two revised versions were compared. Test results indicated that students seeing the second revision scored significantly higher than those seeing the first revision on immediate posttest, but not on retention.

32. THE LACK OF OPPORTUNITY FOR STUDENTS TO RAISE QUESTIONS AND PARTICIPATE IN FREE DISCUSSION WOULD SEEM TO REDUCE THE EFFECTIVENESS OF LEARNING FROM INSTRUCTIONAL TELEVISION, PARTICULARLY IF THE STUDENTS ARE FAIRLY ADVANCED OR THE MATERIAL IS RELATIVELY COMPLICATED.

We have suggested that an inherent limitation of instructional television is the lack of two-way communication between the teacher and the students. On the part of the students, the lack of two-way communication would mean they are unable to raise questions, or to participate in free discussion with the instructor and other students in the class. As Stuit, *et al* (1956), have pointed out, this seemed to be a major concern of their TV-taught students. For those college students, the authors found it was discussion, rather than television presentation, that exerted a greater influence in motivating learning. Even though their TV class had a talkback system, the students still felt participating was easier in a face-to-face class.

The significance of discussion in motivating learning is also indicated in an experiment by the Southwestern Signal Corps Training Center (1953). It was found the trainees did not like television presentation with no talkback system. On the other hand, the students were kept alert when they could be questioned over a talkback system.

Thus it seems clear that students, at least those at a fairly advanced level, may feel dissatisfied because of the lack of free discussion in television teaching. The question that needs to be answered is: To what extent would learning be actually affected?

One rather interesting experiment has been reported by Devault, Houston, and Boyd (1962). They divided 87 elementary teachers into two groups. One group saw 24 half-hour weekly television lessons on mathematics instruction, the other group received 12 lecture-discussions of 90 minutes presented by the same TV instructor. Then half of the teachers in each group had consultant services, averaging five visits a teacher, in addition to the lessons.

It was found that for those teachers taught by television, consultant services resulted in more favorable reactions toward the program, as well as greater mathematics achievement of their pupils. For those teachers taught face-to-face, consultant services made no differences.

It seems that consultant services, which provided an opportunity for questions and discussion, improved learning from television where discussion was otherwise infeasible. In the case of face-to-face teaching, where opportunity for discussion was already available, it is hardly surprising that consultant services added very little to learning.

In an experiment in Australia by the Commonwealth Office of Education (1950), boys in junior technical schools were assigned to various treatments involving viewing a film, plus either discussion, or a reshowing of the film, or both, or neither. The test results indicated that discussion improved learning. So did reshowing.

The findings by Almstead and Graf (1960) are consistent with the discussion effects although a straight comparison with no discussion was not made. They compared fourth-grade and sixth-grade children taught reading achievement by talkback-equipped television with those taught face-to-face. The talkback system could be operated by the students in the classroom and the teacher in the studio. For both grades, the students taught by talkback TV achieved significantly more than the face-to-face students.

However, not all experiments yielded results in favor of discussion. Wilkins (1962) used television to teach arithmetic to third-grade children. During the first six weeks, the experimental group received introduction and follow-up teaching with each television lesson, while the control group did not. During the second six weeks, the groups were reversed. Test results revealed no significant differences due to introduction and follow-up teaching, which may be considered a form of discussion.

Westley and Barrow (1959a) presented news programs by either television or radio to sixth-grade children. While the television presentation resulted in more learning than the radio presentation, no significant differences were found between those students who had a follow-up discussion and those who did not.

We might speculate why discussion did not improve learning in the two experiments cited above. It would be reasonable to assume that discussion would be more important where the material taught is quite complicated, or when the students are of a fairly advanced level. For instance, dissatisfaction with lack of discussion has largely come from college and adult students. It could be that the news programs employed by Westley and Barrow were relatively simple, so that the lack of discussion would not diminish learning. The same thing may be said of third-grade arithmetic, where there seems to be less room for discussion after the TV lecture than in courses of a higher level. Even though this explanation seems to make sense, it should be tested in experiments using subjects of the same level, but varying the complexity of the subject matter being taught by television. Then we shall be able to say with greater confidence whether the complexity of the material limits the effects of discussion.

A number of versions of two-way talkback system have been tried out at the Pennsylvania State University (Greenhill, 1964). The first such system, called Mark I, enabled the student to push a button on a movable microphone box, which would be passed to him when he raised his hand. This told the TV instructor that somebody in a certain room wanted to ask a question. When the instructor was ready, he pushed a signal on his control panel, which lit a green light on the student's microphone box as a signal to talk. Both the student's question and the instructor's reply were broadcast throughout the closed-circuit TV system.

Research conducted on the Mark I system indicated no significant differences in learning between classes where the students could ask questions and classes where the students did not have this opportunity. It may be noted that students in rooms not equipped with microphones could hear both the questions and answers, and therefore really did not miss the discussions even though they themselves could not actively participate. Attitude surveys showed that the students liked the system even though many of them did not make use of the opportunity to ask questions themselves.

The second version, called Mark II, replaced the movable microphone box with a sensitive microphone placed in front of the classroom. This made it unnecessary to pass along the microphone box. Otherwise, Mark II worked essentially the same as Mark I. A few minor technical flaws found in Mark II were corrected in still a later version, Mark III. These talkback devices may turn out (in relatively small systems) to be adequate substitutes for student-teacher interaction in the classroom if the cost of operation can be kept down.

33. IF A STUDENT BEING TAUGHT BY INSTRUCTIONAL TELEVISION CAN BE GIVEN IMMEDIATE KNOWLEDGE OF WHETHER HE HAS RESPONDED CORRECTLY, HE WILL LEARN MORE.

There can be little doubt that delaying the knowledge of performance results will diminish the amount of learning. For instance, in one of the earlier experiments, Ross (1927) let 59 college students perform a tallying task. After an initial one-minute practice period, the students were grouped under three conditions: full knowledge as to day-to-day progress; partial knowledge as to relative achievement in their own section; and no knowledge at all. Later the students changed groups. Analysis of the results indicated that achievement is influenced by knowledge of results.

Similar results have been reported in later experiments. For instance, Greespoon and Foreman (1956) asked their subjects to draw a three-inch line. In the control group the subjects were not told how accurate their lines were. In four experimental groups, this information was supplied after different lengths of delay. It was found that the longer the delay, the lower the rate of learning. But even the longest delay was better than no information.

The question is: To what extent will this be true with instructional television, where the knowledge of results is usually delayed because of lack of immediate contact between the instructor and the students? Before we touch upon this question, we shall first make a distinction between two different situations in which the knowledge of results plays a part. One has to do with the responses the student makes covertly as the lecture goes on, and there may or may not be a deliberate attempt on the part of the instructor to reinforce his correct responses. We shall discuss this point in a later part of this chapter. The other situation has to do with overt responses which the students are required to make, either verbally or in the form of a written test, and which are reinforced with or without delay, or not reinforced at all. Our discussion at this moment will concern the effect of delay in reinforcing the overt responses. In other words, what if the knowledge of test results is immediate, or delayed, or not available at all?

The results of different experiments generally agree, and we shall cite only a few. Smith (n.d.), using a filmstrip to teach facts about the moon to fifth through eleventh graders, gave the students test items after they had seen various lengths of the program. Half of the groups were told whether their responses were correct immediately upon answering each item. For the other half, the knowledge of results was withheld until the following day. Those groups that had the immediate knowledge scored significantly higher in immediate posttests, although on delayed posttests given three weeks later no significant differences were found between the two treatments.

Gibson (1947) studied the learning of aircraft identification by Air Force trainees. In his "unreinforced" method, the subjects viewed 20 slides of foreign aircraft three times. In his "reinforced" method, the first showing was the same as in the unreinforced condition. On the following two showings, the exposure time was cut by half so that the subjects could identify the aircraft on a work sheet and then receive immediate knowledge of the results. The reinforced method resulted in significantly more learning than the unreinforced method. It may be noted that, unlike the results by Smith, the findings by Gibson are confounded by a practice effect.

Similar to the findings by Gibson are those reported by Gropper and Lumsdaine (1961b). Two versions of a television lesson on how movies work were shown to junior high students. One version required active responses from the students, and the lecturer supplied the correct answers immediately afterwards. The other version was exactly the same except no responses were called for. The results indicated that the active response with immediate knowledge produced significantly more achievement than no response.

Michael and Maccoby (1953) showed a film on civil defense against atomic attack to junior high school students. Half of the experimental groups were provided with knowledge of correct responses immediately after each question, but the other half received no such knowledge. The groups that received knowledge of correct responses learned significantly more than the others. The authors concluded that regardless of other variables tested in the experiment, such as participation, overt vs. covert practice, and extrinsic motivation, the most important factor influencing learning is knowledge of the correct response.

Hirsch (1953) designed an experiment that made it possible to compare the effects of knowledge of test results with the effects of reshowing of films. Six films on naval training were shown to 138 Navy ROTC cadets. All subjects took a test immediately after the films, and then either learned or did not learn of their test results under one of six different conditions. Later, all subjects took a delayed test.

The most effective method for learning, not surprisingly, was showing the films for a second time along with the original questions and correct answers. What is noteworthy is the finding that showing the correct answers along with the original questions was more effective than showing the film twice without providing knowledge of the test results. Next in ineffectiveness were: rewarding the correct answers by flashing a light, and supplying the number of correct answers. Even though these two methods provided only partial knowledge of results, they were more effective than the method that offered no knowledge at all.

One kind of delayed knowledge, as distinguished from no knowledge at all, is correspondence work. Perraton (1966) linked correspondence work with a television course in statistics for adult students. Each week the students completed a worksheet and submitted it to the television course in statistics for adult students. Each week the students completed a worksheet and submitted it to the television teacher. He found the combination of these two methods to be particularly effective as a means of teaching mathematics.

These experimental findings indicate rather clearly that the television instructor should provide the students with knowledge of their test results if possible, and with the least possible delay.

34. STUDENTS TAUGHT BY TELEVISION TEND TO MISS THE PERSONAL TEACHER-STUDENT CONTACT, BUT THERE IS INSUFFICIENT EVIDENCE TO SUGGEST THAT THE LACK OF SUCH CONTACT WILL IMPAIR LEARNING FROM INSTRUCTIONAL TELEVISION.

There seems to be little doubt that students taught by television miss the personal contact with the instructor. For instance, Herminghaus (1957) reported that ninth-grade students in television classes felt they missed contact with the teacher. Half of his TV students in the science course and two-thirds of the TV students in the English course even thought they would have learned more if taught face-to-face.

Similar findings have been reported by others. One common reaction by college students taught by television in the Los Angeles City School District (1959) was dissatisfaction with the lack of personal association with the instructor. Macomber, *et al* (1956), also reported that his television students were dissatisfied with the lack of contact with the teacher. Pflieger (1958) reported that even the teachers were concerned about the lack of student-teacher-face-to-face contact.

However, even though the students say they are unhappy about the situation, would the lack of contact reduce the amount of learning? A clear-cut answer to this question is yet unavailable because it is difficult to design an experiment for testing the effects of teacher-student contact without introducing other confounding factors, such as additional learning or practice which may follow as a result of contact. We shall look at a few experiments that in some way bear upon the problem of contact.

Klapper (1958b) let college students in sociology watch television lectures followed by discussions led either by the lecturer himself, or by graduate students, or by other faculty members. The results indicated that lack of personal contact with the television lecturer did not affect achievement. Nor did lack of such contact produce unfavorable attitudes toward the course.

Head and Philips (1961) presented television lessons during the summertime to 66 students preparing to go to college. Interviews with the students indicated that lack of personal contact with the instructor was not considered to be detrimental to learning. The authors suggested that student-teacher contact seemed to be regarded as personally desirable but not essential to the educational objectives of the courses. However, no comparison of learning was actually made.

Bryan (1961) conducted an experiment in which high school students were taught chemistry and physics by television. In addition, some students did correspondence work, others received personal visits by college students, and still others had both correspondence work and visits from college students. Those who had visits could be regarded as having had some contact with a substitute, though not with the television instructor himself. The results showed that the group having both correspondence work and visitation learned significantly more than either of the other two groups in the chemistry course, but the three groups did not differ in the physics course.

Devitt (1961) presented television lessons in mathematics and science to 600 gifted children in secondary schools. The students watched in four different conditions. Some students had only the television lessons plus whatever resources were available from their own schools. A second group had in addition monthly seminars. A third group had biweekly visits from assistants. A fourth group had both seminars and visits. We might consider seminars and biweekly visits to be some form of contact between students and teachers.

The findings are not entirely clear. In the first place, no significant differences were found among the four groups in the science classes. In Mathematics I, the group that received both seminars and visits tended to have the best achievements, while the group that received the television lessons only tended to achieve least well. But in Mathematics II, the seminar-plus-visit group and the TV-only group had about the same achievement scores while the two other groups had significantly higher scores. Apparently the amount of practice plus possibly some other variables were entering into the effect.

One thing seems to emerge from these experimental results, namely, we do not know whether the lack of student-teacher contact will have detrimental effects upon learning. On the other hand, we have rather consistent evidence to suggest that students will be dissatisfied if they are deprived of this contact. Yet the consequence of the absence of contact upon learning is far from clear.

In the first place, we have yet no clear evidence to suggest whether having contact with the television instructor will result in more learning than not having contact with the television instructor. The only experiment cited which tested the effect of contact is the one by Klapper, but she did not have a control group which had no contact with anybody. Her findings suggest that the students will learn equally well as long as they have some contact with some teacher, whether the television instructor, or a graduate student, or another faculty member.

The experiments by Bryan and by Devitt provide us with some fragmentary evidence that television-taught students who have some contact with some teacher will sometimes learn more than students who do not have such contact. But their findings are not quite clear for two reasons. First, the contact implicit in these experiments seems to be confounded by additional learning which may have taken place during a visit or a seminar. Secondly, the findings provide no clues as to under what conditions such contact – if indeed it causes more learning – operates to facilitate learning.

In all probability, the lack of personal contact with the television instructor seems to have little detrimental effect upon learning even though the students may not like the situation. It could be, as Head and Philips have suggested, that personal contact with the teacher may be desirable, but not essential to the educational objectives.

For practical purposes, however, the school will undoubtedly provide some contact with a teacher, not necessarily the television instructor. If the absence of contact with the television instructor should have any adverse effect upon learning – we must say we do not know whether it would – the availability of another teacher would seem to be adequate to make up for this deficiency.

E. Student's Response

35. PRACTICE, WHETHER BY OVERT OR COVERT RESPONSE, WILL IMPROVE LEARNING FROM INSTRUCTIONAL TELEVISION IF THE PRACTICE IS APPROPRIATE TO THE LEARNING TASK, AND IF THE PRACTICE DOES NOT CONSTITUTE AN INTERFERENCE.

A learning situation involves both stimulus and response. In learning from television, the major stimulus is the message coming from the screen. The student can respond in a number of ways, for instance, by thinking about the message, making associations between the concepts, rehearsing the information given, or practicing the skill being demonstrated. What would be the optimal responses the student should make in order to achieve the best results of learning?

The general question of response has been a major concern of learning psychologists, and we shall not attempt to review the literature bearing on this problem. The more specific literature on student participation in learning from film has been reviewed on several occasions, by Allen (1957), by Lumsdaine (1963), and by Lumsdaine and May (1965). Here we shall briefly discuss a few experiments concerning the effects of overt response vs. covert response as a mode of practice.

The problem of overt vs. covert response is a matter of practical concern. While attending to the messages from a television lesson, the student can respond in a variety of ways, as we have suggested. However, much of what goes on in his mind is more or less beyond the control of the instructor. The student may appear to be intently viewing the program, and yet may actually be thinking of something else. One way in which the instructor can be of some concrete help to the student is to direct his response to certain specific elements in the learning task by way of practice. The student's response may be elicited overtly, for instance, by pronouncing a word that needs to be learned, or performing a skill, or more frequently, by answering a question. Or the response may be covert, that is, the student is only asked to think about the correct response without actually saying it aloud or doing it. What we would like to know is: Would such responses, whether overt or covert, increase the amount of learning? If so, would one be more effective than the other? Under what circumstances will such responses contribute little to learning, or be even detrimental to learning? Here are some of the research findings.

In an experiment we have already mentioned before, Michael and Maccoby (1953) showed a film on civil defense called "Pattern for Survival" to high school students. The film was stopped three times, during which the experimenter asked questions on some of the points covered. In the overt response treatment, the students wrote their answers on worksheets. In the covert response treatment, the students were told just to "think" the answers. Half of the students in each group were told the correct answers. A control group saw the film without interruption for questioning. Another control group did not see the film. All groups took a posttest.

We have noted that, regardless of the mode of response, those students who were given knowledge of the correct answers did significantly better. In fact this was found to be the most important factor influencing learning. Both the overt and covert response groups had significantly higher scores than the no-response film-only group, but no significant differences were found between the two modes of response. The mean score of the film-only group was about twice as high as that of the no-film group.

Kendler, Cook, and Kendler (1953) tested the effects of overt response vs. no response upon learning from film. High school students were shown a military film on map reading under various conditions. One group saw the film only once. The other six groups had in addition either one, or two or three reviews of the film. During the review showing, three of these groups were told to call out the names of the map signs as they appeared on the screen. This is the overt response condition. The other three groups were not told to call out the names.

It was found that repeated showing increased learning, a finding consistent with others we have discussed before. Regardless of the number of review showings, overt response resulted in significantly more learning than no response.

In a follow-up experiment by the same authors (Kendler, Kendler, and Cook, 1954) using the same film, four experimental conditions were compared. In the overt response group, the subjects were told to write the correct name when the map sign appeared. In the covert response group, the subjects were told to think of it. A third group received no instruction but was allowed enough time and opportunity for covert response. A fourth group received irrelevant instruction to fill in the time that was allowed the third group.

The results showed that the overt and covert response groups both did better than the two other groups, but there were no significant differences between them. The group that had enough opportunity to make covert responses had higher scores than the no-opportunity group.

The effects of practice response on learning are also illustrated in an experiment by Nasca (1965). Nasca tested other experimental variations too, but we shall only review the one concerning response. He used closed-circuit television to teach science to junior high school students. In the active participation groups, the students were required to make verbal and written responses either to short questions directed from the studio, or to worksheets and diagrams provided before the lesson. Such responses were not required in the other groups. It was found that regardless of other experimental variations, active responses led to significantly more learning than no responses.

These experimental results suggest that some form of practice, whether by overt or covert response, will increase the amount of learning. Between these two modes of practice, there appears to be little difference. This interpretation, however, does not quite agree with the findings from the now classic experiment on effects of practice reported by Hovland, Lumsdaine, and Sheffield (1949). They presented a letter and its phonetic equivalent on a screen, one pair at a time, to all subjects. After six to eight pairs, the subjects had a review. In the "active review" group, the subjects called out the correct phonetic word each time a letter appeared. In the "passive review" group, the subjects were shown both the letter and the phonetic word, which was pronounced by the experimenter just as he did in the learning session. The active review group scored significantly higher than the passive review group. This finding was replicated by Lumsdaine and Gladstone (1958).

Since the active and passive review conditions were analogous to overt and covert response, one wonders why Hovland *et al* found significant differences while the others did not. It may be noted that the subjects in the passive review group were merely receiving a review showing without necessarily making covert response. That is, they were not instructed to "think" about the association. In a later experiment by Kanner and Sulzer (1961), the subjects learning the phonetic alphabet were instructed to think in the covert response condition. The superiority of overt responding was substantially reduced.

A few more experiments may be cited to throw further light on the effects of overt practice on learning. Kimble and Wulff (1953) showed to Air Force trainees two versions of a film on use of the slide rule. One group saw the version that provided aid to the performance of correct participation responses. The other group saw the version with no sound or visual cues to aid correct responses. The guided practice group scored significantly higher in the posttest than the unguided group, particularly for difficult material.

Karsner (1953) used a film loop to teach college men how to play badminton. He had three experimental conditions: (1) demonstration of each stroke by the instructor, followed by a film loop for that stroke; (2) no demonstration by the instructor, only a film loop for each stroke; (3) demonstration of all strokes by the instructor, followed by students' practice of all strokes, followed by all the film loops. No significant differences were found between any of the three experimental groups and a control group, either in badminton knowledge test, or motor test, or in tournaments.

In an experiment reported by Ash and Jaspen (1953b), overt practice was actually found to be detrimental to learning. The task to be learned was the assembly of an anti-aircraft gun breechblock. Among the experimental conditions were room illumination and repetition of the training film, but here we shall be concerned only with the practice effects. The film showed a step-by-step assembly of the breechblock, either at a rapid pace or at a slow pace. The rapid version ran three minutes, the slow version four and a half minutes.

For each version, some of the Navy trainees were told to follow the correct assembly by working with an actual breechblock in their hands while viewing the film. This is the participation treatment. Others were told to wait until the film was over. After the film, all trainees went to tables in the viewing room and assembled an actual breechblock. Their performance was scored by the amount of time required, as well as by a pass-fail score.

It was found that with the slow film, participation resulted in significantly greater learning than no participation. But with the fast film, participation actually interfered with learning, and the no-participation group did better.

Another instance where practice was found to reduce learning is reported by Grosslight and McIntyre (1955). They used films and pictures to teach college students the recognition, not pronunciation, of Russian words. Some students were required to pronounce the Russian words when the words appeared. The authors pointed out that the pronunciation was not related to the spelling. Test results showed that those students who participated by pronouncing the words learned less well in terms of recognition.

Now what do all these experiments tell us about the effects of practice response on learning from film and television? It seems that practice, whether by overt or covert response, will improve learning if the practice is appropriate to the learning task, and if the practice does not interfere with learning.

We shall discuss interference first. It may be recalled that in the experiment by Michael and Maccoby, the film was stopped when the experimenter asked the questions. In the experiment by Kendler, Cook, and Kendler (1953), all subjects first saw the film once without any interference. It was later in the review showing that the subjects were told either to call out the correct names of map signs or to think about them. In neither of these experiments was the major task of learning interfered with by practice response. On the other hand, in the experiment by Ash and Jaspen, the Navy trainees in the participation group were instructed to practice assembling the breechblock at the same time as the film was being shown. In other words, they would not be able to pay attention to the fast film. It is hardly surprising that these trainees did not learn the task well. In the experiment by Grosslight and McIntyre, since pronunciation was not related to spelling, having the students pronounce the Russian words evidently caused distraction and interference with their central task.

The findings by Karsner on badminton playing suggest that in order to be effective, the practice has to be appropriate to the learning task, even though not distracting. Karsner reports that none of his experimental treatments resulted in an improvement in learning over the control group. This would indicate that neither the instruction nor the practice was appropriate to the task of learning to play badminton.

Although both overt and covert responses appear to be equally more effective than no response, overt response may have one advantage over covert response if properly used. This possibility is suggested by the findings of Kimble and Wulff, where guided practice would be easier to achieve for overt response than for covert response. For instance, it would be easier to provide guidance to the students on what to do, than on what to think. If so, then overt response seems to have more to recommend it than covert response where guided practice is feasible as part of the learning experience.

36. NOTE-TAKING WHILE VIEWING INSTRUCTIONAL TELEVISION IS LIKELY TO INTERFERE WITH LEARNING IF TIME FOR IT IS NOT PROVIDED IN THE TELECAST.

Another question having practical significance to instructional television also concerns the student's response. Should the student take notes while viewing a film or television lesson? Or, would note-taking interfere with learning from television?

In face-to-face teaching, this question will hardly arise because the teacher can slow down or pause when he sees the students taking notes. The television teacher does not have this benefit. We shall look at some of the experimental findings bearing on this question.

In an earlier experiment, Ford (1948) showed high school students three different films. During two of the films the students were instructed to take notes. Test results indicated that note-taking tended to be a distraction.

The disruptive effects of note-taking are more clearly shown in an experiment by Ash and Carlson (1951). They also employed films, but the findings should apply to television learning with equal validity. The experimenters randomly divided 216 college freshmen into four groups. One group saw two films on high-altitude flying and ocean survival, and then immediately took a test. A second group saw the same films, took notes while viewing, and took the test immediately afterwards. A third group saw the films, took notes, reviewed their notes for ten minutes, turned in their notes, and then took the test. The fourth group did not see the film but took the same test.

The average per cent of correct answers was above 60 per cent for all three film groups, as compared with 30 per cent for the no-film group. Among the three experimental groups, the film-only group learned significantly more from both films, better than even the note-taking and note-reviewing group. The note-taking no-reviewing group learned least well.

The authors concluded that note-taking interfered with learning, presumably because the films did not provide enough pauses and repetition to permit taking notes.

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This is a difficult chapter from which to frame conclusions, because so many topics have been covered and so many of the findings are unclear. A high proportion of all the areas we have discussed are in urgent need of further research to sort out the variables that are operative but unmeasured.

In general, the findings encourage us to think about some of the basic requirements of all effective teaching and learning, rather than about the production devices that we have at hand with television. The studies we have been reviewing seem to call for simplicity of presentation, clear organization of material, motivation of the learners, knowledge of results, practice – things that are by no means unique to television. They seem also to support the finding which Hoban said (1960) was one of those that could be accepted with high confidence – that cues which locate the material to be learned would benefit learning. And it is significant to have the studies demonstrate that learning can be improved by testing and revising program - something we have known for a long time, but made too little use of. These basics seem to have more to do with the effectiveness of television than do most of the other variations.

This is not a surprising kind of result if we think of television as a pipe through which to put teaching. We might expect that the basic requirements of good teaching would not be greatly different whether all the teaching is done in the classroom or part of it is done in the studio.

However, let us put in a word of caution concerning some of the production devices which have not been proved to contribute much to learning from television. Consider color, for example. There is rather impressive evidence that color contributes little or nothing to the amount of learning. On the other hand, there is some evidence that students like it better, and this liking may grow more pronounced the more accustomed they become to seeing color television. How much is it worth to have students "like" their classes better, even though no additional learning can be demonstrated? All of us have had the experience of enjoying a class very much, even though after some years we decided we learned more in a class we enjoyed less at the time. If color, animation, dramatic interludes, and the like, do indeed contribute to students' enjoying their classes, it may be worth quite a bit to use them on appropriate occasions. In that case, what the research says is that it is not necessary to use color *to achieve efficient learning;* it is not necessary to put any more money into such devices than one is prepared to spend for morale's sake.

One more caution: These findings do not prove that color and its kindred devices do not contribute to learning under *some* conditions. For example, it would be surprising if color could not be used effectively when the item to be used can be set off or located or recognized better in color than in black and white. There must be such cases, but they have probably not been tested.

This leads us back to the statement with which we began – that a great deal of research remains to be done in the areas represented by this chapter. Most of these are one-variable experiments, when many variables may be interacting. Experiments must necessarily be limited to one situation or a few situations. We are far from having a scientific rhetoric of instructional television, and a great deal of re-thinking, research, and reinterpretation will be needed before we have one. As we work toward that, we can do worse than to make sure that television teaching makes use of the principles of good teaching in general.

IV. Attitudes Toward Instructional Television

The research evidence makes attitudes toward instructional television seem rather more favorable than one would expect from the experience reports that circulate. Regardless of this evidence, there is good reason to think that some resistance among teachers has been aroused wherever and whenever television has been introduced for purposes of direct teaching. Sometimes this has taken the form of vigorous opposition; sometimes, merely dissatisfaction or insecurity. In Samoa, which must be accounted one of the more dramatically successful uses of instructional television, opposition from American administrators came out into the open when television was introduced into the schools, and this situation had to be resolved by staff changes. At the Compton Junior College, opposition to a unilateral introduction of television became so intense that the chief executive lost his job and the project was abandoned. More typical, however, has been quiet opposition from the classrooms. The experience reports are full of cases in which there has been less than complete cooperation from classroom teachers, and unfavorable reports have been made by conventionally trained teachers and administrators on unconventional innovations.

Therefore, resistance must be accepted as a fact. As we pointed out in an earlier chapter, instructional television ends the privacy of the classroom; it requires a teacher to learn new roles and procedures; it may seem to threaten the teacher's position and security or to denigrate his importance by turning over much of the lecturing and demonstrating to an outsider; it requires a local school to conform to a central schedule and curriculum; and it operates in one of the most conservative of our social institutions. This could hardly help causing uneasiness, and in some cases either covert or overt opposition. It is to be expected that the uneasiness and opposition would be greater where the schedules are less flexible and where teachers set greater store by their own subject-matter expertise and their ability to lecture – e.g., in secondary school and college. Nor is it surprising that television would be less happily received at academic levels where students have had a number of years of face-to-face teaching, have become accustomed to being able to question or discuss at any time, and have become more articulate and verbal than they were in lower grades.

The evidence does not cast any doubt on the presence of some resistance and unfavorable attitudes, but it is useful in pointing out the locus and limitations of these attitudes, their components, and some of the ways in which television has been successful in establishing more favorable attitudes.

37. TEACHERS AND PUPILS ARE MORE FAVORABLE TOWARD THE USE OF INSTRUCTIONAL TELEVISION IN ELEMENTARY SCHOOL THAN IN SECONDARY SCHOOL AND COLLEGE.

A careful study of attitudes toward instructional television, made in four United States communities by International Research Associates for the Academy of Educational Development, has been published in part along with the Hagerstown and Chicago cases of *New Educational Media in Action* (volumes 1 and 2, 1967). The Hagerstown results are especially revealing. This is a school system in which television had been in use for nine years at the time of the survey, and where there was abundant evidence of acceptance and effective use. Yet even in this situation there proved to be an inverse relation between favorable attitudes and grade level:

Proportions of Different Groups of Teachers and Administrators
Who Agreed with Certain Statements about Instructional
Television (Hagerstown, 1965)

Statements	Administrators	Primary teachers	Intermediate	Junior High	Senior High
Much or some help in teaching	83.3%	76.9%	80.9%	62.5%	40.9%
Provides richer experience	98.7	98.4	96.4	90.0	76.3
Enriches and expands curriculum	91.1	94.2	90.7	77.8	76.0
Limits or reduces curriculum	3.8	3.3	6.4	15.3	18.6
Has no effect on curriculum	5.0	2.5	2.8	6.9	5.4
Improves curriculum planning	91.0	94.0	88.0	81.0	68.0
Improves quality of overall program	97.0	94.0	88.0	81.0	66.0

Even in the least favorable group, the senior high school teachers, it must be pointed out that attitudes were still quite favorable. Three-fourths of the teachers felt that television provides richer experience and enriches and expands the curriculum, and two-thirds felt that it improves curriculum planning. Nevertheless teachers in lower grades were distinctly more favorable.

Westley and Jacobson (1962) reported that they found a sample of fourth-grade teachers in Wisconsin more favorable than a sample of ninth-grade teachers in the same schools. Hardaway (1963) studied 401 teachers in Illinois and Indiana who had been using Airborne television broadcasts. He reported that, while elementary teachers showed no significant change in attitude toward instructional television between a pre- and posttest, secondary teachers were significantly *less* favorable on the posttest. Goetzinger and Valentine (1963), drawing on a questionnaire survey of 204 University of Colorado faculty members, found that faculty attitudes toward instructional television moved from positive to negative along a scale of class-levels ranging from lower division through upper division to graduate study.

What about the pupils? The Hardaway study also sought out the attitudes of 1,633 elementary and 1,487 secondary pupils in classes taught by Airborne television. They found precisely the same result as the teachers: Elementary pupils were as favorable to television on the post- as on the pretest; secondary pupils became less favorable to teaching by television after some experience with it. The question arises, of course, how much interaction must have taken place between the teachers and pupils in setting these attitudes? Curry (1959) found that sixth-grade science pupils in Cincinnati were more likely than seventh-grade mathematics pupils, who were in turn more likely than ninth-grade biology pupils, to prefer instructional television to face-to-face teaching.

There are a number of studies in the literature in which pupils and teachers at different grade levels have been asked whether they preferred instructional television to the face-to-face teaching they had received elsewhere. These studies are confounded by the same problems that invalidate some of the comparative studies of learning from television, and by some additional problems also. There is no reason to describe them in detail. Let us merely record, for what it is worth, that such studies in elementary schools have produced proportionally more preferences for the use of television, than in secondary schools and colleges.

When comparative attitude studies are carefully designed, as in the series of Penn State studies reported by Carpenter and Greenhill (1958), television comes out rather well even at the academic level where attitudes are least favorable. A total of 626 chemistry students were randomly divided into groups that were taught by lecture-demonstration or by television. After four weeks, the students returned to the face-to-face lectures, and then were given the option of remaining in that room or going to the television room. Thirty-two per cent moved to the television room.

In another experiment in this series, 144 business law students were divided into face-to-face and television groups, and after eight weeks all returned to the face-to-face method. Forty-two per cent at that time said they preferred the ITV teaching; when given the choice of returning to ITV or remaining in the face-to-face lecture, 47 per cent chose ITV.

In still another experiment at Penn State, 219 political science students were taught for several weeks by ITV, and then moved to a face-to-face instructional situation. Fifty-one per cent said they preferred ITV; however, 70 per cent actually *moved* to the ITV room.

One hundred seventy-five education students had face-to-face presentation for four weeks and then television teaching for three weeks. A secret ballot revealed that 61 per cent favored continuing the class with the aid of television.

It is clear that other variables beside grade level are involved in determining attitudes toward televised teaching. Carpenter and Greenhill found, for example, that students seated in the back of face-to-face lecture halls were much more likely than others to prefer television teaching. There are a sufficient number of favorable reactions in the higher academic levels, and a sufficient number of unfavorable ones in the lower grades,* to lead us to suspect that the way television is used, rather than the grade level, controls the attitude. Another important factor is, what is the alternative to televised teaching? If it is a skillful, well-liked teacher, a small class, and plenty of opportunity for interaction, most pupils at whatever level would choose face-to-face teaching. If the teacher is not first-rate and the class is in a large lecture hall, they are less likely to do so. When Westley and Jacobson found, somewhat unexpectedly, that 61 per cent of the fourth- and ninth-grade pupils they were studying preferred to take mathematics in a face-to-face classroom, they sought the reasons for the preference. Fewer than 40 per cent of the reasons had to do with television. The largest number of reasons had to do with course content. Evans, Wieland and Moore (1961), too, concluded that if all variables are controlled, attitudes toward teaching by television will depend on the learning principles in the content.

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*For example, Westley and Jacobson (1962) where 61 per cent of fourth- and ninth-grade mathematics students chose face-to-face teaching; Los Angeles City School District (1958), where 84 per cent of high school students thought ITV was at least as good as face-to-face teaching; and Parsons (1955), where University of Michigan psychology of child development students preferred the treatment they were in, whether that was television or face-to-face.

One other small finding is worthy of note. Westley and Jacobson found that the pupils of one of the three teachers they were studying were more favorable to television at a very high level of significance than were the pupils of the other teachers. This suggests either that the classroom teacher encouraged favorable attitudes in the pupils, or that the teacher provided a less desirable alternative. In any case, it is quite evident that the attitude and performance of the classroom teacher will have something to do with the attitudes of the pupils toward the television lessons they are offered.

38. ADMINISTRATORS ARE MORE LIKELY TO BE FAVORABLE TOWARD INSTRUCTIONAL TELEVISION THAN ARE TEACHERS.

Case studies and observation reports suggest that the push to introduce instructional television is more likely to come from administrators than from teachers. This is contrary to the history of language laboratories, where teachers or language supervisors have generally pushed the innovation (Haber, 1963). So far as we know, the history of the introduction of teaching films into schools seems also to reflect a higher proportion of innovation by the teachers than does television. These two latter media are, of course, less threatening than television to the classroom teacher, and they can more easily be pushed by one school because they are local rather than system- or area-wide. Therefore, the impulse to innovate is more likely to come from the teachers, and vigorous administrative backing may be less essential. But numerous case studies credit strong administrative support (for example, in American Samoa and Hagerstown) with much of the success that instructional television has achieved, and lack of such support with some cases of lack of success.

The research on attitudes backs up this conclusion, so far as evidence is available. The Hagerstown survey, cited in this chapter, found that administrative attitudes were consistently more favorable than the average of teacher attitudes. Surveying the colleges and universities of New York State, Starlin (1962) found that New York State University administrators were generally favorable to a program of instructional television, whereas the administrators of private universities and colleges were less favorable, and the faculty members of both public and private institutions expressed "concern and resistance." When Bailey (1961) surveyed Texas colleges and universities for a microwave television network, he found the administrators favorable, but the professors "not convinced that educational TV is a proven success."

39. VOLUNTARY HOME STUDENTS OF TELEVISED COLLEGE CLASSES TEND TO BE MORE FAVORABLE TOWARD LEARNING BY TELEVISION THAN ARE THE STUDENTS WHO TAKE THESE SAME TELEVISED COURSES IN THE CLASSROOM.

There are a number of reports in the literature testifying to favorable attitudes held by adults toward television teaching. Among these are Rock, Duva and Murray (1951b) who found that 75 per cent of a sample of Army trainees would rather be taught by television than by any other method; Hoban (1963) who found that favorable reactions greatly outnumbered unfavorable ones among the students who listened to a televised college class at 6:30 a.m. five days a week; and Beatts (1957) who reported that both IBM customer engineers in training and their teachers became increasingly favorable toward ITV with experience. Several pieces of research bear directly on the comparison of attitudes between out-of-school and in-school adult students. One of these is Janes (1961), who studied 375 college students permitted to choose whether they viewed a televised social science class at home or in classrooms, or took the course from the same teacher without television. At the beginning of the term, 47 per cent of the students were in the TV section, and 53 per cent in the face-to-face section. By the fourteenth week, 11 per cent of the face-to-face students transferred to the television section, whereas 2 per cent of the television students went into the face-to-face section. Thus the course appeared to be about as attractive by television as when taught conventionally. But Janes found a considerable difference between the attitudes of students who viewed the televised lectures at home and those who viewed in television-equipped classrooms. The home students tended to be positive in their evaluation; the others, negative.

A similar finding came out of the extensive Chicago experience with the Junior College of the Air. A certain number of students on campus were assigned to view the televised lectures in classrooms. Whereas the students who viewed at home tended to be enthusiastic about the courses, the classroom students did not, and on the average they made poorer grades than the home students. Dreher and Beatty (1958) and Lepore and Wilson (1958) reported that home television students in San Francisco were better satisfied with the television course than were classroom students, and Meierhenry (1955) reported a parallel finding for teachers taking a course at home or on campus.

These results are apparently related to the conditions of viewing and alternatives available to them. The Chicago home students, for the most part, had no alternative way, except through television, to get a college education. They were home-bound with a family, or physically incapacitated, and therefore were grateful for the television opportunity and highly motivated to do well with it. The classroom TV students, on the other hand, were sitting in rooms where they would otherwise have expected to be able to ask questions and discuss problems with a teacher, but where they were able now only to look at a television tube. The students on whom Janes reported apparently enjoyed the opportunity to sit comfortably at home, perhaps with something to drink or eat, rather than having to go to the campus for the same lecture.

40. AT THE COLLEGE LEVEL, STUDENTS TEND TO PREFER SMALL DISCUSSION CLASSES TO TELEVISION CLASSES, TELEVISION CLASSES TO LARGE LECTURE CLASSES.

We have noted the Carpenter and Greenhill finding that students in the back third of large face-to-face lecture halls were more likely to prefer television than those in the middle of the lecture hall, who were in turn more likely to prefer television than those in the front of the lecture halls. Two other studies bear on this general point. One is the study (French, 1963) of student attitudes at the University of Missouri toward televised and face-to-face teaching. The course was in the social foundations of education. During the first semester, students were taught in a small classroom. The next three semesters, the teaching was by television. In the fifth semester, all students were in a large lecture hall. Attitude scales were developed to measure reactions to the method of teaching, the teacher, and the subject, and administered at the end of each term. We have no assurance that scores are comparable, of course, because different students were in the course each term, and the course may not have been exactly the same. But the consistent order of favorableness (except in one case where ITV was on top) was small classroom face-to-face teaching over televised teaching, and televised teaching over large lecture halls. A parallel finding came out of the evaluation studies at Los Angeles City School Districts (1959), where in general "students accepted ITV classes, but preferred face-to-face classes. Most students preferred an ITV class, if not too large, to a large face-to-face lecture class." This suggestion that size of class may have something to do with attitudes toward televised, as well as face-to-face teaching, is supported by the Carpenter and Greenhill finding (1958) that the proportion of Penn State psychology students who had been taught in small TV classrooms and preferred TV, was significantly greater than the proportion of those who had been taught in large TV rooms.

So far we have been talking about student attitudes. It should be recorded that Goetzinger and Valentine (1963) found an "almost perfect correlation" between class size and attitudes of University of Colorado faculty toward the use of instructional television. Typically if the class was not over 200, they preferred to use television; otherwise, not.

41. THERE IS EVIDENCE OF A HAWTHORNE EFFECT AMONG STUDENTS BEGINNING TO USE INSTRUCTIONAL TELEVISION, BUT NO FIRM EVIDENCE THAT ATTITUDES TOWARD THE MEDIUM NECESSARILY IMPROVE OR WORSEN WITH TIME

Observers often note a "Hawthorne effect" – an increase in interest, favorability, and motivation to do well – whenever a new teaching medium is introduced. The effect has been reported with television, programmed learning, language laboratories, instructional films, and radio. Neidt (1963) notes it in his study of nonintellective factors in learning from the media, and raises the question of how to maintain the initially favorable attitudes that tend to accompany a new learning experience.

There is nothing in the research to indicate that attitudes toward instructional television necessarily must become more or less favorable with time. In some cases, there *is* evidence that students become less favorable. We have already cited a case or two in which secondary school students were less favorable after an exposure to television than before. Dyer-Bennet, Fuller, Seibert, and Shanks (1958) reported that Purdue students taught calculus by television became less favorable with time. Macomber *et al.* (1957) reported the same finding for Miami University students taught several subjects by television. And Pflieger (1958) reported that Detroit school students were losing interest in television instruction after the first semester. On the other hand, Reede and Reede (1963) found that Penn State students taught economics by television became increasingly favorable toward the medium; Nelson (1958) reported an increase in favorable attitudes on the part of students of speech taught by television; and Kumata (n.d.) reported that advertising students taught by television became significantly more favorable toward that kind of teaching. Klapper (1958a) found that some classes were more favorable, some less favorable, on a posttest than on a pretest. It seems probable, therefore, that the important variables have to do with the kind of teaching on television, the conditions for studying by television, and the degree of attitudinal support. In other words, it is the way television is used that determines whether an initial interest in the medium is maintained.

There is support in the literature for believing that teachers are likely to become more favorable toward instructional television if they are actively involved in using it and determining how it is used. This observation is found in several case studies (e.g., Hagerstown, Samoa, Chicago), but also in certain survey and experimental studies. Handleman (1960) found that teachers who had taught by television were significantly more favorable toward it than teachers who had not. McIntyre (1963) found that, while teacher attitudes modified favorably over a year during which they saw something of a televised course produced by their colleagues, the faculty of the School of Dentistry, which had produced the course, were significantly more favorable toward television than the rest of the university on every scale. And Evans, Smith, and Colville (1962) reported that when a group of professors who were strongly resistant to television were allowed to prepare, produce, and present several videotapes, their attitudes toward teaching by television became strikingly more favorable. The principle seems to be that involvement and familiarity may overcome fear and distrust of the medium.

42. FAVORABLE ATTITUDES ARE DISTRIBUTED WIDELY ENOUGH AMONG DIFFERENT TELEVISED COURSES TO CAST DOUBT ON THE ASSUMPTION THAT SOME ACADEMIC SUBJECTS, PER SE, MAY BE DISLIKED AS MATERIAL FOR INSTRUCTIONAL TELEVISION.

Intuitively it would seem that certain courses – for example, a course like public speaking in which the students, rather than the teacheer, are responsible for most of the classroom activity – would be liked less well on television than some other subjects. And this may be. Yet the basic course in speech was taught by television at Purdue (Nelson, 1958) and student attitudes were favorable. A subject like history might seem less adapted to television than a course like physics, in which there is a great deal to demonstrate. But "The American Cultural Heritage" was taught at N.Y.U., with favorable attitudes on the part of students (Klapper, 1958a); and one experiment in the teaching of college physics to a small class by television (Bailey, 1959) produced unfavorable attitudes. (It should be pointed out, however, that the Harvey White physics course broadcast on television proved to be very popular, and other science courses, at various levels, have been favorably received.) High school mathematics by television has aroused slightly unfavorable student reactions in Nebraska; favorable ones in New York and Wisconisn (Neidt and French, 1958; Geddes, 1962; Westley and Jacobson, 1963). Psychology has been received favorably at Rice and Penn State; unfavorably at another university (Evans, 1956; Carpenter and Greenhill, 1958; Dunham, 1960). Subjects as unlike as German, military science, American government, education, and advertising have been taught by television and received favorably. Indeed, complete 12-grade curricula have been taught by television in American Samoa and at Hagerstown, and a complete junior college curriculum has been offered on open-circuit in Chicago – all without directing special attention to any course or subject that was broadly disliked or manifestly unsuitable for teaching by television. In other words, in this instance as in others we have cited, we are apparently not dealing here with the key variable. Whether or not some subjects are less easy to popularize on television, it is not the subject matter that seems chiefly to govern the resulting attitudes of students. They seem to depend more directly on how the subject is taught, and the conditions under which the course is received and studied.

43. LIKING INSTRUCTIONAL TELEVISION IS NOT ALWAYS CORRELATED WITH LEARNING FROM IT.

It would seem that liking would usually go along with learning in the use of instructional television, and this relationship may in general hold. For example, pupils' attitudes are more likely to be favorable in primary school, and – so far as we can rely on the evidence – primary school television classes are probably more likely than classes at other levels to produce a high rate of learning. However, the few correlational studies that are available, raise doubts. For example, Merrill (1956) showed a 45-minute kinescope to farmers and homemakers, then took attitude ratings and measured learning. He found no significant relationship between the liking and learning scales, and suggested that they relate to different attributes of the television program. Whiting (1961) compared the grades obtained by students in history and anthropology taught by closed-circuit television, with their measured attitudes toward television instruction. He found that students who were relatively neutral toward instructional television made higher grades than those who favored television teaching, although the latter scored higher than those who disliked television teaching. Unfortunately, ability levels were not controlled. The conclusion seems to be, not that favorable attitudes are always unrelated to effective learning, but that favorable attitudes are not always necessary for it. As Merrill says, the attitudes may reflect one aspect of the teaching, the learning, another.

44. AMONG THE FACTORS THAT DETERMINE TEACHERS' ATTITUDES TOWARD INSTRUCTIONAL TELEVISION ARE (a) HOW THEY PERCEIVE THE DEGREE OF THREAT TO THE CLASSROOM TEACHER; (b) HOW THEY ESTIMATE THE LIKELIHOOD OF MECHANIZED INSTRUCTION REPLACING DIRECT CONTACT WITH STUDENTS; (c) HOW THEY ESTIMATE THE EFFECTIVENESS OF INSTRUCTIONAL TELEVISION; (d) THE DIFFICULTIES THEY SEE IN THE WAY OF USING MODERN TECHNIQUES; (e) HOW CONSERVATIVE THEY ARE, AND WHETHER THEY TRUST OR DISTRUST EDUCATIONAL EXPERIMENTATION.

A number of studies have been designed to identify the dimensions of teachers' attitudes toward instructional television. Knowlton and Hawes (1962), studying teachers at National Science Foundation summer institutes, reported that two factors seemed to distinguish their attitudes toward the use of audiovisual means of teaching. These were (a) their estimates of the instructional usefulness of such means, and (b) the barriers they saw to the use of such means. Handleman (1960) in a questionnarie study found that 17 out of 40 items differentiated the attitudes of teachers who had and who had not taught with television. Chief among these were (a) fear of a standardized, mechanized education; (b) fear of the non-TV teacher decreasing in effectiveness; (c) concern over lack of student feedback; and (d) distrust of measuring instruments (which may be a generally conservative, anti-experimental factor). In each case, the teachers who had experience with television were more favorable. Hoban (1963) found that the major obstacle to teacher approval of television was an "anticipatory denial of access to interpersonal interactions with the instructor and classmates." Evans, Smith and Colville (1962) reported that pro-ITV teachers, contrasted with anti-ITV teachers, were likely to (a) be more variable in their teaching techniques; (b) be more interested in research; (c) have more teaching experience; (d) be more tolerant of psychological interviews, of night students, and of student activities; (e) show less concern with economic rewards; and (f) be less likely to have colleagues who agreed with their views.

Perhaps the most elaborate study of this kind was by Westley and Jacobson (1962). They correlated and factor-analyzed a series of attitude responses by teachers of fourth- and ninth-grade mathematics in the Madison, Wisconsin schools. Some of these teachers had, some had not, taught with television. The factor analysis isolated ten dimensions of attitude, as follows:

(a) *challenge – threat* (for example, will instructional television impair normal teacher-student relationships, leave too much to the studio teacher, endanger the classroom teacher's advancement and threaten his eventual unemployment?)

(b) *economy* (will it help with rising enrollments, and ultimately save in instructional costs?)

(c) *instructional side-benefits* (can adults learn by watching the broadcasts to schools, and may it not be a good way to acquaint teachers with such things as new mathematics content?)

(d) *partnership* (may the studio teacher not "back up" and strengthen the classroom teacher, and improve student achievement?)

(e) *responsiveness* (will television instruction dull the pupils' interest or contribute to positive attitudes toward the subject taught?)

(f) *parental influence* (how will the parents react to the broadcast lessons they see on the air?)

(g) *security* (could television teaching ever replace the classroom teacher?)

(h) *invidious comparisons* (will the "master teacher" on television make the classroom teacher seem inept at times?)

(i) *experimental attitudes* (even though the value of instructional television is not yet determined, shouldn't we give it a try?)

(j) *in-service training* (will it be useful in bringing teachers new content and new methods in their fields?)

A teacher's general attitude and probable behavior toward instructional television, they feel, will be determined by the stand he takes on these ten dimensions. The names given to the factors were applied by the researchers.

There are a few research studies and a number of experience reports on how teachers' attitudes toward instructional television may be changed. The experience reports say, for the most part, that involvement and in-service training are key elements in making classroom teachers more favorable. If the teacher can have a part in planning what is taught on television, and what classroom activities are built around it, and if he can be given help in learning his new role, he will like it better and do it better. The research, such as it is, backs up those conclusions. Hardaway, Beymer, and Engbretson (1963) found that teachers who used Airborne television courses and who had a course or workshop in teaching with television were distinctly more favorable than those who had not taken such a course or attended a workshop. Devault, Houston, and Boyd (1962) found that among Texas teachers of elementary school mathematics who were using television, consulting services resulted in significantly more favorable attitudes and a higher level of mathematics achievement from their pupils. Among non-television teachers, however, there was no such result. Apparently the television teachers *did* need help in learning their new tasks and procedures.

45. AMONG THE FACTORS THAT DETERMINE PUPILS' ATTITUDES TOWARD INSTRUCTIONAL TELEVISION ARE (a) HOW MUCH CONTACT THEY THINK THEY WILL HAVE WITH A TEACHER; (b) HOW THEY COMPARE THE RELATIVE ABILITIES OF THE STUDIO AND CLASSROOM TEACHERS; (c) WHETHER THEY FIND INSTRUCTIONAL TELEVISION BORING OR INTERESTING; (d) THE NATURE OF THE TELEVISED PROGRAMS THEY HAVE SEEN; (e) THE CONDITIONS OF VIEWING.

Becker (1963) correlated the attitudinal responses of a large number of college freshmen who had not yet been enrolled in a college course by television. Thus their attitudes were based on anticipation, rather than experience. He found two clusters of attitudes: one centering around their estimate of how useful ITV was likely to be and whether it does or does not maintain high intellectual standards; and a second one which he called "warmth" and which centered around their estimates of whether television teaching was likely to be friendly and pleasant, or cold and mechanized. Andrews (1960) reported that secondary students who had been taught high school algebra by television liked *least* the absence of personal contact between the studio teacher and students, and the fact that they were unable to interrupt the television to ask a question. They liked *most* the fact that the TV lesson (so they reported) required more student attention, and that all students got the same outline and the same level of instruction.

These results fit with the attitudinal surveys made by International Research Associates among Hagerstown and Chicago students (see *New Media in Action*, vols. 1 and 2, 1967). Hagerstown students reported that the quality that tended to make non-television teaching easier for students was that they could ask questions when they wanted to, get personal help from the teacher, and participate at any time in discussion. The qualities that recommended television teaching were the excellent visual materials given by television, the fact that television courses were better prepared and more complete, and the expertness of television teachers. In Chicago, the students of Television College were asked what they liked and what they didn't like about that kind of teaching. The most frequent favorable responses were:

	Proportion of all respondents
The television teacher is better prepared, organized, covers the course better	28%
Television teachers are good, the best, better than classroom teachers	10
Provides an opportunity to see and hear people, eminent persons, panel discussions	12
Good visuals	9
(These favorable responses appear to relate to quality.)	
Convenience of not having to travel to school	28
Opportunity to attend class in informal atmosphere	10
Can make audio-tape and replay for study	7
More flexible time-schedule than classroom courses	12
Lessons are shown twice; one can pick up a lesson the second time around	16
(These responses seem to relate to convenience.)	
Provides otherwise unavailable opportunity for education	26
(This relates to the special nature of the Chicago Television College, which teaches many home-bound students.)	
No interruptions; teacher can go right on, without questions, distractions	19
(This is the other side of the coin: Apparently the opportunity to ask questions of the teacher is not valued equally by all students.)	

What did they *not* like? These were the chief responses:

Cannot ask questions	42
Lack of personal contact with the teacher	35
Television teacher goes too fast; if get lost, can't catch up	19
(These responses relate to the lack of direct contact with a teacher.)	
Television is boring, monotonous, difficult to pay attention to	19
Poor quality of the instruction; courses are not so good as they should be	17
(This is the quality dimension.)	

	Proportion of all respondents
Too much distraction in auditorium; large classes are noisy.	14%
(They prefer small rooms or home viewing.)	
Lack of classroom discussions, recitations	22
Difficulties with the return of papers; no information about where the mistakes were made	9
Time for telephoning to ask questions is too short	8
Lack of contact with fellow students, no informal discussions, no one to talk to about the course	8

(These comments apparently relate to the particular situation of teaching students at home, and would not so directly apply to teaching shared by a studio and a classroom teacher)

In each case it was found that the favorable responses were more frequent, and unfavorable ones less frequent, among students who had taken at least 15 hours of television than among those who had taken less than 15. Whether a self-selection factor operates to help bring about this difference is not known.

There are only a few studies that allow us to interpret some of these comments about quality of television teaching in specific terms of course content and teaching method. Brandon (1956) concluded that college students, other things being equal, found interview and discussion formats more interesting than lectures for television courses. Gropper *et al* (1961) found that girls become significantly more interested in science when a student was used to demonstrate an experiment on television than when an adult was used; boys showed no difference in their reaction to adult and to student demonstrators. However, with student demonstrators, more students, both girls and boys, were likely to do the experiment at home. Starlin and Lallas (1959) found that college students in Oregon would accept televised instruction from other campuses as readily as from their own campus.

Several experiments have tried to relate the use of a "talk-back" system (a communication line from classroom to studio) to attitudes toward television teaching. Rock, Duva, and Murray (1951a) found that too many trivial questions tended to be asked on the talk-back system, and that this disturbed the class. However, a study by the Southwestern Signal Corps (1953) indicated that the talkback system helped keep military trainees alert, and that with the system a student did *not* prefer a class directly with the teacher to a televised class. Reede and Reede (1963) reported that a small percentage of students found that talkback system frustrating or mildly disturbing, but not so many as found it frustrating or disturbing not to have the teacher present; and attitudes of students toward ITV improved during the course in which the talkback device was used.

In view of recent uses of television as a tool by which teacher trainees can observe classroom practice, it may be interesting to note a few attitudinal studies on this technique. Thompson (1960) found that students preferred direct observation to televised observation, and both of these to films of classroom practice. Voorhies (1960) reported that students judged direct observation to be slightly better in some respects than televised observation – mainly because they could see more and could direct their attention where they wished. They suggested that an ideal system would be three cameras bringing three different views of the classroom to the students outside.

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Thus there are few absolute guides in the research on attitudes toward instructional television. There is a tendency for attitudes to be more favorable toward teaching by television in the early grades than the later ones, but this is not always true. There is no good reason to doubt that instructional television may be either liked or disliked at almost any grade level and in almost any subject matter; and the way it is used, along with the conditions of its use, rather than grade level and subject, will decide what attitudes it draws forth. A student's attitudes toward teaching by television seem to relate closely to how he perceives the quality and interest of the course, how frustrated he is at having to wait until the end of the broadcast to ask his questions, how he perceives the alternative to being taught by television, and his feeling about the conditions of viewing. A teacher's attitudes seem to relate closely to his estimate of what television is likely to do to the classroom teacher's present status and future prospects, and his perception of how effectively it works in the classroom. If a teacher can be made to feel involved and if he can be helped to learn his new role, then his own improved attitudes are likely to be reflected in student attitudes, and he is more likely to integrate the broadcast into an effective classroom situation – which will make both students and teacher like it better.

V. Learning from Television in Developing Regions

Television is being used to contribute to education in more than fifty countries of the world. Many of these are in the stage of "developing." What do we know about the effectiveness of the medium in developing countries?

46. THERE IS NO EVIDENCE TO LEAD US TO BELIEVE THAT CHILDREN LEARN ANY LESS EFFICIENTLY FROM TELEVISION IN DEVELOPING COUNTRIES THAN ELSEWHERE.

Less research has been conducted on learning from instructional television in developing countries than in the industrialized countries of Europe and North America, but what has been done is in no respect less favorable or encouraging than the research in the developed regions.

For example, in Niger where some first-grade classes were taught by television and classroom monitors, the children were carefully tested at the end of the year in the four subjects they had studied – spoken French, reading, writing, and arithmetic. When their performance was compared with the standard average for the grade in Niger, these were the results:

79 per cent scored better than the standard average in spoken French;

88 per cent scored better than the standard average in reading;

56 per cent scored better than the standard average in writing;

more than half scored better than the overall average for arithmetic, but their performance varied with the level of abstration – in concrete problems, 89 per cent (better than average); semi-concrete, 87; mental problems, 75; oral, 70; applied, written 50; abstract, written, 33.

The Niger examiners concluded that television in the classroom would not only produce satisfactory learning, but would also improve the average of class performance over what it had been. (Schramm, Coombs, Kahnert, and Lyle, p. 76; and IIEP, I, *passim*.)

In Samoa, the high school entrance examinations at the end of the first two years of the television experiment made it possible to compare public school children who had been taught by television for two years, for one year, and not at all, and children who had been taught throughout the eight grades by American teachers in mission schools. This first set of tests – necessarily tentative until confirmed by later results – indicates that children who have television for even one year do considerably better in the entrance examinations than those who have not had it, and those who have been exposed to television teaching for two years do about as well as the mission school graduates taught by foreign teachers. (Personal communication.)

In Colombia, some thousands of pupils taught in part by television were tested against a comparable group taught from the same syllabus, but without the aid of television. This kind of comparison, of course, is subject to the same cautions and qualifications we have made previously in discussing United States comparisons of television with classroom. Eight meaningful comparisons were possible. In three of them, the television students did significantly better; in the other five, there were no significant differences. The three comparisons that favored television were grade 2 language, grade 5 mathematics, and grade 4 natural science (Comstock and Maccoby, 1966). The ones in which the differences were not significant were two science and three social studies classes.

In several countries, television has been used as a main source of literacy instruction. Very few quantitative results are available on these cases, but literate graduates stand as evidence of success. For example, in the Ivory Coast, television has been used, in connection with monitored groups, to teach 800 men to read, write, and do simple arithmetic, so that they could assume positions as middle-level supervisors in industry (Kahnert, Capelle, and Navaux, 1967).

We shall have more to say later about the use of television in developing regions for in-service training of teachers. Let us note here, however, that in Algeria a combination of television and programmed instruction, intended for teachers, was tested against a group taught the same material in the classroom, and the experimental group did considerably better (Lyle, Jong, Kahnert, and Lestage, 1967). In Colombia, an in-service course on the new math was given by television to about 1500 teachers. The amount of learning was quite impressive. The more programs a teacher viewed the more he learned. And if a teacher viewed in a group or in combination with a class, he learned significantly more than if he took the class only or viewed without a group or class. (Schramm, Coombs, Kahnert, and Lyle, 1967, p. 78).

There is some evidence from Japan (Ishikawa, 1959) of students in remote isolated regions learning less efficiently from television than do city students, but this is believed to relate to their previous preparation and perhaps to the classroom context in which they worked. Later we shall have something to say about reports of difficulties in primitive cultures in learning to interpret pictures and drawings, but these are apparently soon overcome.

It should be added that such research as there is indicates that *all* the instructional media are effective in developing regions. For example, an experiment in teaching geography with films in New Delhi resulted in the film-taught group learning significantly more than a class taught the same material, without films, by a classroom teacher (National Institute, 1961). In Turkey, when films on physics (originally made for television) were added to a course, there was no significant difference between scores made by students who had experienced teachers and those whose teachers were inexperienced – whereas without the films, there were large differences (Turkish Ministry, 1961). The effectiveness of radio was demonstrated by a large-scale test of radio rural forums in India, in 1956, as we have cited before, and by an experiment in teaching primary subjects by radio in Thailand (Xoomsai and Ratamangkala, 1960), among others. Recent reports of the effectiveness of programmed instruction in a developing situation have come from Rhodesia (Hawkridge, 1967).

47. UNDER SUITABLE CONDITIONS, TELEVISION HAS BEEN SHOWN TO BE CAPABLE OF HIGHLY MOTIVATING LEARNING IN DEVELOPING REGIONS.

It is difficult, of course, to separate the Hawthorne effect from the lasting effect of television on student motivation. Nevertheless, the reports are encouraging, and have led observers to believe that television, used skillfully and in a proper classroom setting, can contribute interest and incentive rather than boredom.

Two examples from Africa will illustrate the nature of many reports from developing countries. From Niger, this report was made at the second year of the television experiment with first-grade pupils:

"The attitude of the pupils can best be described by comparison with pupils receiving the traditional schooling in schools nearby. From our own observation and that of the teachers connected with the stations, the pupils receiving the television instruction have much happier faces, are more spontaneous, and seem far more interested in attending school. In the classroom they are free and joyous, and sometimes seem to be absolutely enchanted.

"In complete liberty and of their own accord, they will often clap their hands and dance and sing. This does not create any problem of discipline, however, as the monitors know when it is time to restrain enthusiasm in a firm but friendly manner.

"Two points can be mentioned which will show the interest of the pupils in this method of instruction: Unlike the other schools, there is no absence on the part of the pupils – there was none even during a recent epidemic. They not only come to school, but they come early in order not to miss the first television transmission." (Lefranc, 1967, p. 33).

From Zambia, this report was made at the end of an experiment in teaching literacy and fundamental education to adults by closed-circuit television:

"When television is used, the effect of the classroom teacher on student attainment is relatively slight. However, not only the statistical results must be considered. When there was a classroom teacher there was better classroom organization than when there was no teacher. But even without the classroom teacher, television teaching appeared to have the power to hold a class. The television classes had a far more satisfactory attendance record than the classes at the Adult Education Centres at Rhokana. . . . The holding power of television teaching is a most important advantage, as one of the failures in many courses for adults such as are run by the copper mines is that the normal drop-out makes it almost impossible to run the courses efficiently." (Cripwell, 1966, p. 84.)

The effect need not necessarily be positive. For example, in Samoa where the general effect in the primary school was to heighten interest and motivation, frequent objections were made by high school students that the television lectures were boring, largely because there was unsatisfactory discussion and interchange in the very large classes after the television. Therefore, the way these media are used, as well as the media themselves, determine class reaction.

48. ILLITERATE PEOPLE NEED TO LEARN CERTAIN PICTORIAL CONVENTIONS. THERE IS SOME EVIDENCE SUGGESTING THAT THESE CONVENTIONS ARE NOT HARD TO LEARN.

We generally know how difficult it can be when we try to communicate with people from another culture by means of verbal symbols. The same word can mean entirely different things even though the two persons both know its dictionary definition. The awareness of such difficulty sometimes results in a tendency to rely heavily on pictorial symbols. The assumption is: If people cannot understand the words, they surely will understand the pictures. This assumption plays a key role in our efforts to introduce instructional media like film and television to developing countries.

However, from what we now know, this assumption does not always hold. An often cited example is the experience by Holmberg in Peru (Holmberg, 1960). When the Peruvian villagers saw a health film showing enlarged pictures of lice, they thought these were an entirely different species of animal. Holmberg found his audience totally unable to see any connection between the film and their own life. Any features that were not completely realistic were misunderstood.

Such baffling experience has been reported by other researchers who have tried to teach people in developing countries by means of films, pictures, and posters. Court (1959), for instance, found his Nigerian audience unable to understand pictorial illustrations. The biggest object, rather than the one in the foreground, was taken to be the most important object in the picture. Also, a whole object must be shown. One shot of a goat's head was mistaken tor that of an old man because the goat had a beard and his four legs were not shown. In other words, nothing should be left to the imagination.

In addition to these difficulties with visual conventions, Court found that the perception of pictures was handicapped or distorted by the cultural experience of his subjects. Because North Nigerian buildings are not rectangular, these new literates could not recognize drawings of house interiors having vertical lines and right angles. Also, a doctor is known by his stethoscope in Nigerian towns. If he is shown as a person carrying a black bag, he will likely be identified as a west African barber. A house with curtains in the windows is seen as a house of prostitution.

Marsh (1951) found in an experiment conducted in Johannesburg that African children had trouble with two-dimensional perception. A similar experience was reported by Holmes (1960) in Kenya. Holmes found that his subjects usually could see perspective only when the same type of objects followed each other, like a row of houses. When different objects at different distances were shown, perspective was often lost. Also, he found pictures are not self-explanatory. While objects could be shown smaller than life, magnified objects (flies and mosquitoes) were not recognized.

Winter (1963), experimenting with the perception of safety posters by Bantu industrial works, found that even colors had special symbolic meanings to the natives. For instance, the red color was seen as fire.

The experience of Spurr (1954) seems to suggest that some of his Tanganyikan subjects might have been puzzled by the fact that the objects in a picture do not move. He found that with motion, the objects were much easier to equate with life. Although color was found to help bring a picture closer to reality, it is not as spectacular an improvement as monochrome with motion.

Similarly, Fonseca and Kearl (1960) found in their experiment in rural Brazil that comprehension of pictorial symbols is reduced by excessive or insufficient detail, unfamiliar subject matter, and imaginative treatment. Single pictures for a process requiring several steps were not understood.

What all these findings suggest is: We would be taking too much for granted if we assumed that people having different experiences with visual images would see a film or still picture the way we do. To understand a picture requires certain visual conventions which have to be learned. Besides, certain cues and symbols may have meanings to the natives in a way quite unexpected to the outside communicators. In this sense, knowing the culture will be absolutely necessary if one wants to prepare a program of instructional materials for successful application to a developing country.

As to the visual conventions, the natives must be taught to read pictures just as they need to be taught to read printed material. The observation by Morton-Williams (1953) in Nigeria indicates that it is not too difficult for the natives to learn the visual conventions commonly found in film. His audience, mainly school children, quite rapidly accustomed itself to this medium of communication, and on the whole comprehended and remembered a satisfactorily high proportion of the material presented.

Several other researchers have offered advice on how to help the natives understand a pictorial presentation. Saunders (1953) found that western themes and background contributed to failure of understanding by Indian villagers. The first picture must be of a familiar kind. There should be no trick angles or partial objects. Repeating pictures seemed to bore his audience. If an idea needs to be repeated, repeat it in commentary.

Holmes (1963), working in Kenya, also found that familiar objects are more easily understood than unfamiliar ones. Pictorial symbols should be realistic. Illustrations on a process should have as many pictures as there are stages in the process. Comprehension is reduced by either unnecessary detail or excessive deletion of detail.

Spaulding (1956), based on work done among newly literate adults in Costa Rica and Mexico, found that illustrations need to be presented in terms of the past experience of the audience. Effective communication of specific ideas could be achieved by minimum illustrative objects and realistic portrayal, including the use of color. Spaulding found that captions add to information difficult to depict pictorially.

One approach to pictorial presentation which seems to have had considerable success with Latin American and African audiences is the Walt Disney-type cartoon. From a preliminary survey conducted in certain districts in Mexico, Salvador, and Guatemala, Disney (1955) reported that cartoon films about disease and infection seemed to be easily understood by the most backward and illiterate people. His explanation is that humor is a quick way to communicate with other people.

In a study of health education in Baganda, Ladkin (1951) found that Disney-type cartoons suitable for his African audience. Two other kinds of films also found suitable were documentary which provided familiar general background, and story-telling didactic film.

Pickering (1954) used three cartoon films by Walt Disney: "Hook Worm," "The Way Disease Travels," and "The Winged Scourge." The films had vernacular commentaries. For his naive audience in Gold Coast, Pickering found these Disney cartoons quite effective. The characters in the cartoons need not be "africanized." He suggested that cartoons which leave nothing to the imagination are a good way of making the unsophisticated people realize the dangers of worms and infections in a manner they had never been able to visualize before. However, even though the results of the Disney-type cartoons appear encouraging, it must be pointed out that these are more or less impressionistic findings. Their validity need to be further checked by more careful experiments.

49. WHEN MEDIA ARE INTRODUCED FOR UPGRADING THE LEVEL OF INSTRUCTION, THEN IT HAS PROVED VERY IMPORTANT TO TRAIN TEACHERS IN THEIR PROPER USE AND TO KEEP IN CLOSE TOUCH WITH THEM.

The importance of adequately training the teachers in the use of educational television can be hardly overemphasized. The training involves two aspects: operation and maintenance of the equipment, and playing a proper role in the instructional environment.

For teachers in well-developed countries, the operation and maintenance of television sets may seem trivial. Yet failure to pay attention to such simple things has led to serious problems in developing countries. For instance, in one case (Beardsworth, 1966) several hundred television sets were issued to schools, but after a short time most of them were found to be defective. In some cases, the sets had even been removed from the schools.

One way to solve problems like that is to organize seminars for teachers. The Indian experience suggests that such seminars could be quite helpful. During the seminars, the teachers were taught how to handle the receivers, how to handle television in the classroom, and how to follow up the telecast lesson.

However, experience in some of the developing countries has shown that merely training the teachers is not enough to ensure successful use of the media. There must also be follow-up work to make sure that the teachers are doing what they are supposed to do, to find out what their problems are, and to help them solve these problems. This was essentially the conclusion of a group of educators who met in 1966 to discuss the use of educational media in several developing countries, including India, Nigeria, Uganda, and West Indies (Beardsworth, 1966). They found that in many cases the programs seemed to be of a good quality and suitable for the local audience. But the system often broke down through insufficient briefing of the teachers and lack of follow-up. These educators found it without question essential that some liaison officers should be appointed to visit schools regularly.

In the educational television project in Nigeria, such a liaison system was put into practice. With the assistance of two U.S. AID specialists, the liaison section prepared and distributed visual aids, issued timetables, and distributed detailed notes for each television lesson as well as other materials for use in the classroom. Besides, the liaison section visited the schools and assisted the teachers with any problems that arose at the end of a session.

It is only through such close follow-up that actual problems can be discovered and solved. The magnitude and variety of problems can be illustrated by the experience in Colombia, perhaps one of the best documented studies of instructional television in developing countries. Here we shall cite some of the reports by Peace Corps volunteers whose job was to make sure that the classroom teachers were doing the right things (Comstock and Maccoby, 1966a):

Volunteer 1: (March 2, 1965, Medellin) ". . . the director had not changed the recess schedule – and thus during a TV lesson everybody but the one class was in recess, and the noise was very distracting. . . . He said it would be impossible to change the schedule, but that he would try to keep the noise down to a minimum. . . ."

Volunteer 3: (March 9, 1965, Honda, Tolima) "Awful, awful, utilization in this school which hasn't been able to use TV because of all the technical problems. There's lack of order and discipline, with one exception the teachers are very poor, and it's one chaotic mess. . . ."

Volunteer 4: (March 8, 1965, Medellin) "An unbelievable case – but it happened. (After recounting an earlier experience where the teacher skipped the utilization portion of the television lesson because she had to go to church, the volunteer continued.) I returned to watch her class today. Her motivation for the TV class was to begin at 1:55. When two o'clock came and she still hadn't shown up in the TV room, I went to look for her. Her watch had the same time as mine, but she said she hadn't noticed it was so late. (After wasting another five minutes in lining up her group and marching them down the hallway, she discovered she did not have the guide for that lesson.) . . . In the end I gave her my guide and since she hadn't read it she said she was afraid she couldn't do a very good utilization for the program. She was right. . . . "

Volunteer 6: (February 24, 1965, Medellin) "Went to another small town, Copacabana, to see if their Phillips set had been installed. The TV was in the house of one of the parents who was safeguarding it. The director didn't want it nor the problem of having one teacher having to move all the time, nor the problem of security. . . . "

Volunteer 8: (March 4, 1965, Medellin) ". . . During the TV class the children were restless and did not answer questions put to them by the TV teacher. I asked the teacher why the children didn't answer and she said that she didn't think they were supposed to. . . . "

Many more incidents like these can be cited, but the above are enough to indicate that after a lesson has been put on the air, the problem has just begun, not ended. We have cited these examples not because they are peculiar to Colombia. Similar problems have most probably happened in other developing countries which have adopted instructional television. We don't hear about them because they have not been as carefully recorded as in Colombia. The point is: There must be close follow-up work to make sure that the class-room teacher is playing his role properly.

50. RESISTANCE TO TELEVISION AND OTHER MEDIA IS LIKELY TO BE NO LESS IN DEVELOPING COUNTRIES, BUT THE SIZE AND URGENCY OF THE PROBLEMS ARE LIKELY TO PROVIDE GREATER INCENTIVE FOR OVERCOMING IT.

Instructional media, being innovations, often run into resistance when first introduced, particularly in developing countries where the value systems do not encourage innovation. The resistance comes at times from school administrators, but more typically from the classroom teachers who feel their status and security are being threatened by the intrusion of the media.

The situation can sometimes be quite discouraging. Take the experience of India for instance. A survey of school broadcasts found that only 11 per cent of the schools equipped with radio sets claimed to have used the facilities regularly, and another 26 per cent very occasionally (Kapur, 1961). In Bombay, in 80 per cent of the schools equipped with radio sets, there was no provision for timetables for listening. The equipment was often faulty and badly maintained. Reception was poor.

In an earlier experiment by "All India Radio" (Gupta, 1956), it was found that out of 45 schools selected to try out radio programs for classroom listening, only 6 actually made use of them. Very few teachers realized that radio could be a useful instrument of education. The author found the teachers "silently hostile" to this new instructional medium.

The complexity of resistance by teachers is also indicated by the Colombia experience. When the television project was introduced, it actually aroused great enthusiasm among Colombian teachers. At least this is the impression one gets from reading their answers to questionnaires. Yet the teachers were not always ready to change their ways to make what is suggested to be better use of television. "When teachers are asked to adopt what is described as a markedly new way of teaching," the authors report, "they defensively dismiss the new way as already in use. Having done so, they give it ready and eager lip service, because they have seized on the idea that it is what they are already doing. The sum is a very strange, although not inexplicable, brotherhood of enthusiasm and apathy whose father is fear – fear of change, and what it implies about the value of their way of doing things." (Comstock and Maccoby, 1966c, pp. 42-43.)

The Colombia study offers some interesting suggestions as to how we can best overcome the resistance by teachers. Two kinds of appeals were tried out. One, called the "efficacy" appeal, followed the normal approach of trying to convince the teachers that the new way now suggested to them is a more effective way of teaching. However, this approach has the implication that their old way is no good, and thus may arouse defensiveness. Therefore, another appeal was tested. Referred to as the "professional" appeal, this approach says in effect that if the teacher would give the advocated practice a try, he would be acting like a true "professional." The authors found some evidence that the "professional" appeal was persuasively superior to the "efficacy" appeal. Those receiving the "professional" appeal were ready to devote more time to learning more about the advocated teaching practice. There was also evidence indicating that the "efficacy" appeal did lead to greater defensiveness.

Although teachers tend to resist the use of instructional media, we have some evidence suggesting that such resistance is not insurmountable, if given time. Again take India as an example. When television was first introduced to the schools (Australian Broadcasting Commission and NHK, 1964) there was resistance by teachers, but this resistance gradually broke down until most teachers came to accept television as they did any other classroom aid. It was also found, rather interestingly, that resistance came not so much from the good teacher, who accepted it quickly, nor from the poor teacher, who accepted it without admitting the welcomed help. The resistance came mostly from the moderately good teacher who never wanted to admit that anyone could do better than he. By and large, the Indian experience would seem to indicate that the size and urgency of the problems facing educators in developing countries are likely to provide additional incentives for overcoming teachers' resistance.

51. FEEDBACK FROM THE CLASSROOM TEACHER TO THE STUDIO TEACHER WILL BE HELPFUL TO EFFECTIVE USE OF THE MEDIA.

Just as it is important to train the classroom teacher and make sure that he is playing his role properly, it is also important for the studio teacher to know that the lessons presented on television are appropriate for the pupils. Thus a successful instructional television program depends to a great extent on the continuous feed-back from the classroom teacher to the studio teacher. In a developing country where the use of instructional media is often initiated from outside the native culture, this kind of feedback would assume even greater importance.

It is almost never the case that the classroom teacher will be completely satisfied with the lesson presented by the studio teacher. In India, for instance, some teachers felt strait-jacketed by the inflexibility of the television syllabus, because even where gaps are left for the classroom teacher, they must be filled according to a rigid timetable (Australian Broadcasting Commission and NHK, 1964).

In an earlier study conducted in India (Tagare, 1959), 500 secondary schools in Marathi-speaking districts were surveyed for a diagnosis of the reactions by teachers and headmasters to educational radio broadcasts. Although only 129 replied, the results are illustrative. Some teachers simply did not believe that radio had any importance as a teaching aid. Among other comments were: Radio broadcasts had no utility value from the examination point of view, timetables were overcrowded, some teachers were unwilling to do additional work involved in the use of school broadcasts, radio distracted the pupils and affected their progress. The author suggests that many of the complaints seemed to be based on lack of information and inadequate understanding about teaching and learning.

Because of the richness of data it furnishes, we shall again cite the Colombia experience (Comstock and Maccoby, 1966d). Through four carefully administered surveys of teachers participating in the project, with sample sizes varying from 130 to 1,885, the authors found that the degree of approval given by the teachers to the various televised courses varied markedly. The ratings were generally the highest for courses in natural science, and the lowest for courses in social science. As time passed and procedures improved, the degree of approval by teachers increased.

However, there were complaints, the two most frequent ones being: that the televised courses covered too much material, and that the children could not see clearly objects, maps, and things which were shown. On the average, about one out of five teachers made these complaints.

Slightly more than one out of 10 teachers complained that the television programs entertained but taught very little. Slightly less than one out of 10 teachers complained that the programs did not teach concepts, but only facts. More complaints were made about social science, language, and mathematics, than about music. Only in one instance was a complaint made about courses in natural science.

The complaints followed different patterns for different courses. For courses in language, the teachers thought that the program only entertained, but taught very little. For courses in social science, the complaints were that the programs covered too much material. For the complaint that the children were not able to see clearly, mathematics stood out for two semesters, and language in the second semester.

Although it would be difficult to say how much generality the findings from Colombia have for other developing countries, these are nevertheless real problems encountered in a major project, and in that sense may be useful to other countries in their planning for instructional media.

52. THERE IS AMPLE EVIDENCE THAT THE NEW MEDIA, PARTICULARLY TELEVISION, ARE EFFECTIVE FOR IN-SERVICE TRAINING OF TEACHERS FOR DEVELOPING REGIONS.

In developing countries where qualified teachers are in short supply, instructional television has much to contribute toward upgrading the performance of teachers. We might expect that the telecast instruction to the pupils would give the classroom teacher an example of how to conduct a lesson more effectively. But a more direct way of improving teaching is through in-service training of teachers. Because of its relatively easy deliverability, television can bring new knowledge and new teaching techniques to a large number of teachers. This type of use of new media has been tried with a considerable amount of success in developing countries.

For instance, in the face of an acute shortage of teachers for Palestinian refugee children in the Gaza Strip, Jordan, Syria, and Lebanon, the UNRWA/Unesco Institute of Education started an in-service training program, using correspondence assignments supplemented by direct teaching, where audio-visual aids were effectively employed (Lyle, Petrouchine, and Kahnert, 1967). The authors found high enthusiasm and appreciation by the trainees. Interviews with headmasters brought forth remarks about how the trainees shared their new skills and insights with other teachers in the school, and about changes the in-service training had brought in the classroom performance of the teachers.

Another example of successful use of the new media for in-service training is provided by Algeria (Lyle, Jong, Kahnert, and Lestage, 1967). When Algeria obtained independence in 1962, it lost 80 per cent of its qualified teachers. But within three years, enrollment in schools nearly doubled. This serious problem was solved in part by the use of a large number of substitute teachers who received in-service training through films, programmed instruction and instructional television.

Here we shall report in some detail the experience in Colombia (Comstock and Maccoby, 1966b), where certain problems arising from the use of instructional television for in-service training were systematically observed.

When instructional television was introduced to Colombia, an in-service training program on the "new math" was offered to the teachers. The program consisted of lectures on set theory, number system, laws of basic operations, etc. The programs were televised at the rate of two a week, each lasting 30 minutes. The new math was chosen because the teachers had voiced considerable anxiety about their ability to understand it. It seemed to be a subject about which they really wanted to know more. Viewing was optional for teachers in three districts. Comparison of test results showed that those teachers who viewed the entire series scored twice as high as those teachers who did not view the series at all. Even though the teachers were not randomly assigned, the authors felt the significant difference in test scores between the viewers and non-viewers was unlikely to be the result of self-selection, because no differences were found between the two groups in such factors as sex, age, education, or teaching experience. Thus the findings provide further evidence that television could be effectively used for in-service training in a developing country.

The findings about teachers' reactions to the television in-service training in Colombia were also interesting. When asked for their opinions, the great majority of Colombian teachers expressed a preference for in-person instruction, rather than television instruction, as a form of in-service training. But those who viewed all of the telecasts were found far more favorable to television in-service training than those who did not view any programs.

It is quite possible, as the authors pointed out, that such favorable disposition might have existed before viewing, and thus might be the cause of greater viewing. But since most Colombian teachers did not have much prior experience in television viewing, the authors felt that the other interpretation, namely, viewing contributes to a more favorable attitude, seems the more likely. Therefore, although a large proportion of teachers doubted that they could learn as much from television as from in-person instruction, this barrier would seem to have given way after the teachers had some actual experience with learning from television.

Upon further analysis, the authors found that most teachers considered in-service training by television to be ineffective largely because of lack of feedback. Most teachers did not highly regard discussion among themselves as a substitute for feedback from their expert instructor. However, those teachers who did participate in discussion were found not only to be more favorable to in-service training by television, but also to have scored higher in the tests.

The Colombian experience suggests that in-service training by television can be quite effective. There will be certain barriers, but these barriers can largely be overcome when the teachers begin to participate in the training programs.

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Thus the outlook for television in the developing regions is very promising. The serious question is not whether pupils in developing countries can learn from it. Rather, the questions are whether it is the right medium for the situation, whether the country can afford it, whether the necessary technological base and the necessary engineers and technicians are available to support, and whether the logistics and the in-service training can be provided to make it work in the classroom. If these questions can be answered affirmatively, then a number of characteristics of instructional television recommend it to the attendtion of the developing countries.

VI. Learning from Television: Learning from Other Media

Which medium? This is a difficult and complicated question for many schools and for many developing nations trying to expand and improve their educational systems. In the following pages we shall not be able to review much of the research on the other media, but can at least suggest some of the findings that are useful in trying to decide among them.

53. GIVEN FAVORABLE CONDITIONS, PUPILS CAN LEARN FROM ANY INSTRUCTIONAL MEDIA THAT ARE NOW AVAILABLE.

Our review of the literature up to the present has clearly indicated that television and film, as instructional media, can efficiently teach students under conditions that normally exist in schools. What do we know about the effectiveness of other instructional media, like radio, language laboratory, and teaching machines?

Most of the experiments on radio for classroom teaching in the United States were done in the 1930's and 1940's. We shall look at some of them, and then cite a few examples from research done in some of the developing countries.

Carpenter (1937) prepared 15-minute radio lessons on science for pupils ranging from fourth grade to senior high school level. Results of term-end examinations indicated that pupils taught by radio did as well as or better than those taught by conventional methods. Reports from pupils showed a high degree of interest in radio lessons.

Brewer (1939) presented radio broadcasts to elementary school children as part of their instruction in science. Comparison of post-test scores showed that the radio group learned significantly more than the control group. The radio group was found to have a higher interest and more favorable attitude toward science than the control group.

In an experiment reported by Heron and Ziebarth (1946), 98 college students in general psychology were divided so that one-half attended classroom lectures while the other half listened to the same lectures over the radio. Halfway through the course, the two groups changed places. Mid-session and final examination results indicated that the radio was as effective as the face-to-face instruction.

One of the best examples of the effectiveness of radio as a teaching instrument in developing countries is the farm radio forum in India (Mathur and Neurath, 1959). A total of 145 villages in Bombay State, averaging about 850 people per village, were chosen as the experimental group and provided with radio sets. A similar number of villages without radio sets served as the control goup. In each experimental village a leader was selected to conduct the listening sessions and follow-up discussion. Twenty special farm programs were broadcast twice a week from 6:30 to 7 p.m., on Sundays and Thursdays. Comparison of test results both before and after the broadcast programs found a significant increase in knowledge in the radio forum villages, but only negligible increase in the non-radio forum villages.

To cite a few other examples, radio has been found effective in teaching literacy to villagers in Malaya (Entwisle, 1955), in teaching English to elementary school children in Ghana (Kinross, 1961), and in teaching French to native school children in Tahiti (Medard, 1962). In Thailand, a sample of schools which had access to radio instruction was compared to a control group consisting of schools of similar characteristics, except for the absence of radio instruction (Xoomsai and Ratamangkala, 1960). Grades two and three were compared in music, grades six and seven in English. For grades two and three, the radio group had a significantly better average performance than the control group. For grades six and seven, the radio group scored significantly higher on reading and writing tests, although no significant differences were found in aural tests between the two groups.

In an experiment conducted by NHK in Japan (NHK, 1955), seventh-grade pupils were taught English in four periods a week. The same textbook was used for both the experimental group and the control group. During the last 15 minutes of three periods each week, the experimental group also listened to an English radio program presented by the NHK national educational radio station. The radio programs reviewed the material covered during the regular period by the classroom teacher. The control group did not listen to these programs. The overall results of three tests indicated the experimental group learned substantially more than the more than the control group.

In another Japanese experiment (NHK, 1956), elementary school children in the experimental group received a 15-minute music program from the radio in their regular 45-minute period, while the control group received instruction only from their own music teacher. The experimental group had higher scores in all tests in both the third and fifth grades, although the differences did not reach a significant level.

The general conclusion from these studies is that radio can be effectively used as an instructional medium.

Another audio teaching method is the use of language laboratories. Felt (1961) used tape recordings of actual French radio programs in language laboratories to teach an experimental group of college students. The control group students were taught the identical material by their own teachers. The laboratory students showed marked improvement in aural comprehension when compared with the control group students. In vocabulary tests, the two groups showed no significant difference.

Moore (1962) divided homogeneously grouped seventh-grade students in French into two groups. The experimental group received supplementary instruction in a language laboratory three times a week for six weeks. The control group did not use the language laboratory. Results of oral posttests showed that 50 per cent of the experimental group students had improved their speaking ability, while in the control group no students showed any marked improvement. In the written posttest, 75 per cent of the experimental group students improved their scores, as compared with 50 per cent in the control group.

Lorge (1962) compared secondary school students who used language laboratory facilities with those who did not. The language being learned was French. After a three-year period, it was found that students using the language laboratory learned French without detriment to the traditional skills of reading and writing. Although listening comprehension was not significantly improved by the use of the language laboratory, speaking competency was. And students using the language laboratory showed more interest in French.

A rather interesting innovation in the use of radio for language teaching was reported by Cook (1964). College students in elementary Spanish served as subjects. The experimental group students were each provided with a pocket radio, which was equipped to receive broadcasts of 303 Spanish drill exercises and a limited amount of text material programmed in a stimulus-response pattern. The control group had only the classroom instruction. Midway through the semester, the control group students were also given radios because they felt themselves to be at an unfair disadvantage.

The data indicated that the experimental group students had about 11 times as much drill as the control group students. The experimental group scored significantly higher in most tests before the control group acquired radios, but after that, the differences between the two groups gradually disappeared. After they received the radios the control group students showed a significant increase on stimulus-response test scores.

The effectiveness of programmed instruction, as well as the limiting conditions, has been the concern of much theoretical discussion and experimental research. Among the recent works are those by Green (1962), Hughes (1962), Lumsdaine (1961), Lumsdaine and Glaser (1960), Glaser (1965). The general finding is that under appropriate conditions, programmed instruction can teach efficiently. By the mid-1960's programmed instruction was found in use in such diverse localities as England, Japan, Germany, France, Scandinavia, the Soviet Union, Rhodesia, Jordan, Ethiopia, and Brazil, to mention just a few (Schramm, 1964a). Here we shall cite only a few studies to indicate the use that has been made of programmed instruction.

Herbert and Foshay (1964), reporting on an experiment in a suburban high school in Long Island, found that students in grades seven and eight taught English grammar by programmed instruction (English 2600) learned significantly more than the conventionally taught students.

Schramm (1964b) found a great deal of learning from the same English grammar program (English 2600) in an extensive experiment in Denver schools. Overall, the students who studied the program learned as much as the students who had class practice.

Austwick (1962) compared secondary school students in England who were taught algebra by programmed instruction with those taught by conventional instruction. Although immediate posttest results favored the control group, retention several weeks later was better for the experimental group.

Birch (1962) used both pictorial and verbal cues to teach deaf children symbolic communication. The experimental group was taught by programmed instruction, and the control group by conventional instruction. The criterion was the ability to construct 50 sentences in response to 50 pictures. The experimental group required only 386.5 minutes to complete the program, as compared to 900 minutes for the control group. On five of six language variables, no significant differences was found between the two groups, although the control group did better on the sixth variable.

Brown (1962) used a program to teach mathematics to high school students. The experimental group had a combination of classroom instruction and programmed materials, while the control group received classroom teaching only. The experimental group was superior to the control group both in a test of general ability, and in eight out of nine achievement tests during the school term.

Obviously, under some conditions these media are more effective than under others. But the general conclusion emerging from the various experiments cited thus far seems to be: Under appropriate conditions, students can learn from any instructional medium, whether it is television, film, radio, language laboratory, or programmed instruction.

54. THERE APPEARS TO BE LITTLE IF ANY DIFFERENCE BETWEEN LEARNING FROM TELEVISION AND LEARNING FROM FILM, IF THE TWO MEDIA ARE USED THE SAME WAY.

Quite a number of experiments we have reviewed were about learning from film, rather than learning from television. Even though there seems to be no difference between a film and a TV prgoram, except for the size of the screen, we still would like to know whether this is actually so.

Jackson (1952) conducted an experiment in the early days when television had just come into use. He presented a program on atomic defense to 240 airmen in several versions. One was a kinescope, another a black-and-white film, still another a color film. Half of the airmen seeing a particular version were told it was a kinescope (from television) while the other half were told it was a film.

The results were most interesting. No matter which version the airmen saw, they learned significantly more if they were told it was a kinescope. The author concluded that a novelty effect had produced more learning among those airmen who thought they had seen a television program.

Such novelty effect, however, did not last very long. Three years after the Jackson experiment, Hurst (1955) conducted a replication. In addition to the same program on atomic defense which Jackson used, Hurst also used programs on manila and wire rope, survival at sea, and measuring instruments. The subjects were 931 Navy recruits. The same procedures were followed, that is, some recruits were told they were going to view a kinescope, others, a film. No significant differences were found in any of the comparisons. The author suggested that the novelty effects noted by Jackson seemed to have disappeared in the intervening period.

55. TELEVISION AND RADIO HAVE CERTAIN ADVANTAGES OVER FILMS IN FLEXIBILITY AND DELIVERABILITY.

It is easier and quicker to alter an instructional program on television or radio than on film. This is because few school systems will make their own moving pictures, whereas they will produce or collaborate in the decisions on producing most of their instructional television and radio. Even when a television program is stored on videotape or radio program on audiotape, still it is relatively easier to respond to critical feedback from the classroom and to changes in curriculum than when the program is on a motion picture film. Thus, in theory at least, radio or television teaching should be fresher, more nearly up-to-date, more often revised, more quickly responsive to local needs and to reports from users, than film teaching; whereas film programs, on the other hand, because most of them are turned out by professional film makers and a longer time is available for preparing and editing them, might be expected to look less local and more "professional."

It is easier to deliver television or radio over a wide area than to serve the same area with films. Although films have the great advantage of being usable when the teacher needs them, rather than according to a central schedule which is the result of a compromise and doubtless serve no one perfectly, it is no simple task to set up a system by which the films a teacher needs can be delivered to him at precisely the time he needs them. Few schools have collections of films completely adequate to all their needs, and therefore must rely to some extent on central libraries that deliver films usually by courier or mail. Therefore, any film is going to be in transit a much greater proportion of time when it is going to be in use; and copies may or may not be available when teachers want them. Furthermore, this system places the responsibility on the teacher to know the films that are available and call for them at the appropriate time. Although television and radio take certain choices of time and subject matter away from the teacher, they are able to distribute good teaching – which may often *include* films or sound tapes – very efficiently and quickly to as many potential users as have receivers.

In developing countries, particularly, the stocking of a film library and setting up of an adequate delivery system for individual teacher choice, has proved to be a problem. In these countries it has often proved advantageous to broadcast a high percentage of film and tape content (for example, science films or taped drama), thus using broadcast as a "big theater" or a "big phonograph."

56. RADIO IS LESS EXPENSIVE THAN TELEVISION; ECONOMY OF SCALE USUALLY GOVERNS COST COMPARISONS OF TELEVISION AND FILM.

Cost comparisons between instructional media are extremely slippery because of the difficulty in finding cases of clearly comparable subject matter to test, and the difficulty of being able to measure outcomes in a way to relate them usefully to costs. Therefore, we shall say little about the problem here, and defer to the economic study which is to follow in this series.

A few points of comparison seem to be clear. For one thing, the cost of television is considerably greater than that of radio. This is because of the greater initial capital investment (television transmitters, studio facilities, and receivers, all cost more than the corresponding items for radio), and also because of larger operating costs (producing television programs requires more skilled personnel). The rule of thumb is that television costs about five times as much as radio for a comparable unit of instructional time. This is borne out by the two lowest examples of cost of primary school teaching by television and radio which were turned up by a recent study of instructional media in 18 countries. In Colombia, it was discovered, television instruction was being delivered to about 400,000 pupils at an average total cost, including both operation and amortization of capital investment, of about 5 cents per pupil-hour. This means that if a pupil received six 20-minute television classes per week, it cost ten cents. If he received this amount of televised instruction during 30 weeks of the school year, the total per-pupil cost of television was then $3.00 per year. On the other hand, Thailand delivered radio instruction to about 800,000 pupils for a little less than one cent per pupil-hour. If we assume six 20-minute lessons for 30 weeks a year, this totals between 50 and 60 cents per pupil school year. (See Schramm, Coombs, Kahnert, and Lyle, 1967.)

Costs as well as accounting methods of school systems, vary greatly. In the study previously mentioned of 18 countries, in which an effort was made to apply the same accounting procedures in all cases, television costs were found to vary from 5 cents to over two dollars per pupil-hour. The chief element of variability appeared to be the scale of the system. Because of the large initial cost and the relatively large demands of central production, both television and radio systems represent better investments when they are used by large numbers of students. Once the number of users rises over a few thousand, and the number of hours of use climbs over a few hundred per year, then the unit costs go down very rapidly. The cost curves for different amount of use in Schramm, *et al* (1967, pp. 139, 142) are worth inspecting. They are, in every case, exaggerated J-curves. The implication is that television and radio are mass media, whether used for education or otherwise, and if they are to be used efficiently they must be used in a mass way.

It is in economy of scale that the costs of a film operation differ from those of television, and the costs of a recording operation differ from those of radio. At some point on the scale of size, the unit cost of a broadcast service becomes lower than that of a film or recording delivery service. To test this, of course, we should have to find or assume a situation in which the educational outcomes of the two were identical, and this is something we cannot assume and have the greatest difficulty in finding. Perhaps the closest approximation was an experiment by Radio Television Francaise which calculated the relative cost of distributing some of their radio instructional programs on discs rather than over the air. They found that the break-even point came with an audience of about 3,000. Once this number was exceeded, then it became less expensive to distribute by radio. (Bureau d'Etudes ORTF, 1964.)

The precise break-even point for film and television would depend on a number of variables – the cost of films, cost of projectors and receivers in the given location, cost of delivery, and the like – but almost certainly there would be a point when it would become more economical to deliver televised instruction to some number of thousands of students than to deliver films to them. This break-even point can be estimated for any given situation, but cannot be stated generally.

Thus in deciding among instructional media on the basis of cost, it is necessary to include at least three estimates – the size of the audience to be served, the difficulty of stocking and delivering films or recordings, and the pedagogical advantages to be derived from a particular medium. For example, it is a serious question for many developing countries whether the pedagogical advantages of television over radio are sufficient to justify the greatly increased cost; and whether, if only a small school system is to be served, the advantages of expert and flexible central teaching are to be preferred to investment of the same money in films and a delivery system, with resulting advantages in classroom control.

Technical change is occurring swiftly in these fields, and with it will undoubtedly come changes in relative costs. For example, if 8-millimeter films come into general use in schools, both projector costs and film costs should be decreased. At present, a 16-mm sound film projector costs perhaps twice as much as a television receiver. Videotape recorders are now available for less than 5 per cent of what the least expensive videotape recorder cost ten years ago, and these prices will continue to fall, until they are easily within the range of many school systems. If satellites can be used to deliver television to schools, the resulting economy of scale should make possible most dramatic reductions in unit costs, although, of course not in capital investments.

57. MORE COMPLETE CONTROL OF FILM BY THE CLASSROOM TEACHER GIVES IT A POTENTIAL ADVANTAGE OVER TELEVISION.

The advantages of film over television, or tape over radio, in the hands of a skillful classroom teacher, will be obvious.

The teacher can introduce the film at any time that seems to be optimal for it. The film can be stopped at any time for discussion. Any part of the film can be played over again for closer observation. The entire film can be reviewed if necessary. The same advantages apply to tape. Some pauses and repetition are built into television or radio teaching, of course, but they must be decided centrally, and may or may not fit the needs of a particular class at a particular time.

These undoubted pedagogic advantages of control by the classroom teacher must be balanced against the difficulty of obtaining the right films or tapes exactly when needed, and must be evaluated against the ability of the teacher to know exactly what films or tapes are best for a given occasion and to use them effectively. There is thus both a potential advantage and a disadvantage in being able to turn these decisions over to a central programmer.

When reliable videotape recorders become available at lower costs and schools acquire them as they now typically acquire film projectors, most of the pedagogic advantages of classroom control will be available to users of instructional television as well as to users of film.

58. THE USE OF VISUAL IMAGES WILL IMPROVE LEARNING OF MANUAL TASKS, AS WELL AS OTHER LEARNING WHERE VISUAL IMAGES CAN FACILITATE THE ASSOCIATION PROCESS. OTHERWISE, VISUAL IMAGES MAY CAUSE DISTRACTION AND INTERFERE WITH LEARNING.

One advantage often attributed to instructional television is its ability to facilitate learning by presenting visual images. For instance, Westley and Barrow (1959a) found in their experiment that children learned more from news programs when presented on television than when presented on radio. It may also be recalled that in the experiment by Williams, Paul, and Ogilvie (1957), students of anthropology learned more from television than from radio.

The basic issue, however, is not whether television is a more efficient teaching instrument than radio. Rather, the issue is whether the visual images on television will increase the amount of learning. We shall review a number of experiments, and then discuss their implications.

One of the most interesting findings on visual images was reported by Ketcham and Heath (1963). Undergraduate students were taught the life and work of William Wordsworth. There were other experimental variations, but we shall discuss only the use of film versus the sound track. The visual portion of the film did not directly illustrate the audio portion, but provided a background for the narration. For example, a summary of a poem was accompanied by the scene which inspired it, or the spot where it was composed. Or an event in the poet's life was accompanied by scenes from the place where it occurred. Students who saw the film learned significantly more than students who heard the sound narration only.

Similarly, Vander Meer (1950) reported that high school students in history classes learned more from filmstrip presentation than from written material composed from the commentary used in the filmstrip.

The effectiveness of visual images has also been reported in language teaching. Grosslight and McIntyre (1955) taught college students the recognition of Russian words. Some students were shown the words only. Other students were shown the words along with pictures. The latter learned significantly more. Similar results had been reported by Kale (1953).

Tannenbaum (1956) presented lessons on periodontics to practicing dentists. Three of the experimental groups received both the lectures and the visual images, two groups from television, and one group from a filmstrip. A fourth experimental group only studied the written manual. A control group received no instruction. All three visual groups had significantly higher test scores than the control group, but the manual group did no better than the control group.

In an experiment reported by Levinson (1962), some students were shown movies based on the stories by O'Henry, Daudet, and Poe. Either before or after the movies, these students also read the stories. Other students read the stories only. Those who had seen the movies appeared to have learned significantly more than those who had not.

However, there are also quite a few experiments where visual images seem to make little difference to learning. Glasgow (1961) used as his subjects 181 elementary and secondary schoolteachers undergoing in-service training in the use of radio or television for teaching. Four training methods were compared: workshop, classroom visits, audio-visual materials, and printed materials. The training lasted two years. Objective achievement tests at the end of the programs indicated no significant differences among the four training methods.

Evans (1964) prepared an hour-long filmed interview with Carl Jung. Some of his students in psychology were shown the film. Others read only the printed transcription of the interview. Test results showed that both groups learned from the presentation, but there was no significant difference between the two groups.

Beach (1960) compared three television news programs. One program consisted of motion pictures covering 16 news stories. Another program showed still pictures taken from the motion pictures and accompanied by the same narration. The third program had a newscaster reading the same narration but showed no pictures at all. The subjects were high school students who were about eight years old when the news events occurred, so they had little prior knowledge. Test results indicated no significant differences among the three presentations in terms of the number of correct answers.

We shall cite one more study before discussing the general conclusion we may draw from these experiments. Hartman (1960) designed a rather elaborate experiment in which 1,184 freshmen at Pennsylvania State University saw various versions of a film which gave 5-second presentations of 25 people looking up and smiling. Meanwhile the name of each person appeared on the screen and an announcer read the name. Some versions omitted the audio, others omitted the video. In some, the filmed person was blocked out; in others, the person's name was blocked out. Altogether seven different versions were employed: audio, print, pictorial, audio and print, audio and pictorial, print and pictorial, and finally, audio, print and pictorial.

After viewing the film, or merely hearing the names pronounced, each group saw a test film containing 5-second presentations of 75 people. They were required to identify which 25 they had seen (or heard) before. To find out whether the form of testing would affect the learning scores, some students saw the test film in print only, others in audio only, and still others in pictorial form only.

One further restriction must be noted. A group that had only seen the pictorial form, without seeing or hearing the names, could not be tested by a version that had only the print, or the sound, or both but containing no pictures. The students simply would not be able to tell. Conversely, the pictorial test film could only apply to those groups which had seen a film containing these pictures. It could not apply to those groups which had only seen or heard the names. On the other hand, the group that had only heard the names could still be tested by a film that only showed the names in print, and vice versa.

The test results were rather interesting. For those groups tested by the pictorial form – and all these groups had seen the pictorial version before, with or without the additional information of names in print or in sound or in both print and sound – for those groups no significant differences were found. This means that if the test is administered in pictorial form, the additional information in print or audio presented in the learning film makes no difference. Of course this does not necessarily mean those groups that had received such additional information had not acquired additional learning. Very probably they had. But their additional learning, if any, simply had no chance to show up in the test results.

What about those groups tested by print or audio? We shall first look at the results from the print test film, which parallels the most commonly used form of testing. The highest scores were achieved by the group that had seen the names in print only. This group had significantly higher scores than all other groups except the one that had both seen and heard the names, which in turn had significantly higher scores than all other groups. The group that had seen the pictures and heard the names, but had not seen the names in print, did least well. It may be recalled that the group which had seen the pictures and heard the names, but had not seen the names in print, did least well. It may be recalled that the group which had seen the pictures only was not tested by the print film version. These findings would suggest that if the test is administered in print form, the group that has learned the task in print form will do best. Additional information presented in pictorial form during the learning process seems to cause interference.

The test results from those groups tested by the audio film version were not quite clear. The pictorial-and-audio group had significantly lower scores than the audio, print, audio-and-print, and audio-and-print-and pictorial groups.

In a follow-up experiment, new subjects in each of the seven learning treatments were tested by a film that both showed the pictures and had their names printed and pronounced. In this case, the group that had received the audio-print-pictorial learning did best, the audio-and-print group a close next best, and the print group third best. It is interesting to note that the pictorial-only group did least well.

In another follow-up, additional subjects were tested by (1) audio-and-print, (2) audio-and-pictorial and (3) print-and-pictorial film versions. For the groups tested on the audio-and-print channels, the one that had received the learning in audio-and-print scored the highest. For those groups tested on the audio-and-pictorial, and the print-and-pictorial channels, the results were not quite clear.

By and large, what have all these experiments told us? The general conclusion that emerges is: The effects of visual images upon learning do not seem to be uniformly beneficial. Whether visual images will have beneficial effects, or no effects, or even adverse effects, seems to depend on the kind of learning task involved.

If the learning involves some degree of manual task, like the treatment of periodontal diseases by dentists, then visual images would be expected to aid learning, as Tannenbaum has found. Or, if the visual images could facilitate the association process, as they often do, then we would expect better learning when the students are shown the visual images. The better results obtained when the students saw the Russian words along with the corresponding pictures provide an apt example. The greater amount of learning achieved by Vander Meer's history class which had seen the filmstrip, and by those students who had viewed the film about Wordsworth, even though the scenes there merely provided a background for the commentary, could be explained along the same line.

On the other hand, there must be many learning tasks where the presentation of visual images will add very little to learning. The in-service training of teachers reported by Glasgow appears to be one such example. These were not novice teachers, and they probably would be able to visualize what a classroom situation would be with or without the aid of visual images.

As a sheer speculation, it seems whether visual images would help the association process would depend on the individual's familiarity with the two concepts that are to be associated. If the person is already highly familiar with the two concepts, then the use of visual images probably has little to contribute. For instance, you don't have to drop an apple in order to teach a child that things will fall if someone is not holding them. On the other extreme, if the person is totally unfamiliar with the two concepts, that is, if the two concepts have never been in his experience, visual images probably will not be of much help either. Imagine a shepherd brought to this country from a village in Nepal and introduced to a dozen businessmen in Manhattan. Having seen these gentlemen face-to-face probably is not going to make it easier for him to remember their names. It is probably in the cases that lie between those extremes that visual images will facilitate the association process.

The experiment by Hartman would suggest that there are learning tasks where the presentation of visual images may actually cause distraction and thus interfere with learning. This finding seems to be particularly relevant to instructional television, where the child's attention may be distracted by certain objects or actions on the screen which may have nothing to do with the task being learned. That is, certain incidental learning may impair the intended learning.

The findings by Hartman also suggest that the relative contribution to learning by the pictorial, print, and audio channels has to be seen in terms of the form of the test instrument. If the test is administered in a pictorial form, then the learning has to be achieved mainly through visual images. If we assume that the form of test is a valid index of the learning task, this would mean that whether visual images have much to contribute depends on whether the learning task is essentially visual or not. If the learning task is not visual, and if the visual images do not facilitate the association process – as shown in Hartman's experiment – then chances are that presentation of visual images would impair learning. Visual images would by definition be irrelevant.

Two more points need to be discussed. First, it may be recalled that the television news presentation by Westley and Barrow resulted in more learning than did the radio presentation. This finding was replicated in a subsequent experiment by the same authors (Westley and Barrow, 1959b). It seems that in these cases, the presentation of visual images – scenes of the news events – might have facilitated the association process in learning. However, in a comparable experiment by Beach we have cited, the television news program having motion or still pictures produced no more learning than the program where only the newscaster appeared on the screen and read the same narration. In the latter case, even though no scenes were shown, the appearance of the newscaster could have served the function of focusing the audience's attention, and thus brought about more learning than one might expect from a radio presentation. Although this is mere speculation, it does raise a possible question, namely, whether the increased learning resulting from visual images is due to the facilitation of association, or due to a closer focusing of attention. This also illustrates how difficult it is to isolate the factors that contribute to learning from the instrumental media.

The second point has to do with the question of why the film on Carl Jung did not produce more learning, while the film on Wordsworth did. Of course, not having seen either film, we can only speculate. In the first place, while the film on Wordsworth provided interesting background scenes about the poet's life and works, the film on Carl Jung was just an interview. Even so, we would still expect the film on Carl Jung to produce more learning than merely reading the transcription if we assume that the appearance of the speaker will help focus attention. As a plausible speculation, it may be recalled that the subjects in that experiment were all psychology majors, to whom an interview about Carl Jung could appear to be test-relevant material. If so, they would probably pay equally close attention whether the material appeared in print or on a film.

59. THERE IS SOME EVIDENCE TO SUGGEST THAT MOVING VISUAL IMAGES WILL IMPROVE LEARNING IF THE CONTINUITY OF ACTION IS AN ESSENTIAL PART OF THE LEARNING TASK.

Having discussed the effects of visual images in general, now we come to the relative effects of motion pictures and still pictures. It can be argued that because the motion pictures produce a higher fidelity of representation than still pictures, the former may bring about more learning. On the other hand, if the two are equally effective, then we should probably use more still pictures in case the cost of production has to be kept down. For instance, if we introduce instructional television to a developing country, cost will be a serious problem.

Leboutet, Lefranc, and Nozet (1949) conducted an experiment in which they found motion pictures resulted in more learning than stills. A total of 150 French children were taught lessons about mountains, a vertebrate animal, and the Paris Basin. The experimental classes saw filmstrips and films, both integrated into the lesson. The control classes saw still pictures, post cards, drawings, maps, and, for the lesson on the vertebrate animal, actual animals.

Before the experiment, the two groups were at about the same level. After one month, the experimental classes showed better learning than the control classes, and at the end of the experiment this superiority became even greater. The experimental classes also seemed to show more interest, more creative activities, better teacher-pupil relationship, and better discipline, although these differences were not statistically tested.

Lasser (1955) compared the effectiveness of a film and a specially produced filmstrip having identical commentaries in teaching a manipulative task. His subjects were college students and Air Force men. When the overall performance of the film group was compared with that of the filmstrip group, no significant difference was found. But when the task was analyzed step by step, it was found the film group did better in one step where the continuity of action played an essential part.

However, not all experiments comparing the stills with the motions found significant differences. For instance, in an experiment reported by the Instructional Film Research Program (1954), different versions of a riot control program were shown to military police trainees. Some trainees saw the original film of actual riot scenes. Others saw a series of still pictures taken from the original film. A third group saw pictures of crowds from a library instead of the riot crowds. All three versions had the same commentary. A control group did not see any film or pictures. Test results showed that all three experimental groups learned more than the control group, but no significant differences were found between the group that had seen the original film, and the two other groups that had only seen the pictures.

Laner (1954) taught college boys and military men the dismantling and reassembly of a sash cord window. One group saw a film, while the other group saw line drawings only. The accompanying commentaries were the same. No significant difference in performance was found. In another experiment (Laner, 1955), college students were taught to assemble the Bren gun. No significant difference was found between the group that saw the film and the group that received only the commentary plus two diagrams.

In the experiment by Beach (1960), it may be recalled, no difference in learning was found between the group that viewed a television news program in motion pictures and the group that saw an identical news program except still pictures were shown.

What these experiments suggest is that moving visual images do not add significantly more to learning than still visual images do, unless the continuity of action is an essential part of the learning task, as Lasser has found. Otherwise, students will learn as well from still visual images as from moving visual images.

It is not quite clear why Leboutet *et al* found motion pictures more effective than still pictures. Their results appear particularly puzzling because the still picture group also saw some actual animals. Not knowing the exact conditions of his experiment, we can only guess. For one thing, this was the only experiment we have cited where the subjects were elementary school children. In all other experiments, the subjects were either adults or teenagers. It could be that motion pictures are more interesting to children at this age level, as the authors seemed to suggest, and therefore bring about more learning. But more likely, as Leboutet *et al* reported, the better learning could be due to the fact that for the experimental classes, the films and filmstrips were integrated into their lessons. Leboutet *et al* did not explain in detail how the still pictures, post cards, maps, and animals were employed in the control classes. If these teaching aids were not so well integrated, then this could conceivably account for the inferior learning by the control class children. Further research is needed to clarify this point.

60. STUDENT RESPONSE IS EFFECTIVELY CONTROLLED BY PROGRAMMED METHODS, REGARDLESS OF THE INSTRUCTIONAL MEDIUM.

Since we now have both instructional television and programmed instruction, we might wonder whether the two could be combined to make a more effective instrument of teaching. A few experiments have been conducted to test this possibility. The findings seem to suggest that, in some cases at least, programmed television instruction is very effective.

For instance, Gropper and Lumsdaine (1961a) prepared two television lessons each in two forms – a conventional television lecture and an experimental "programmed" lesson on television that called for active responses from the students. In the lesson on heat, the students who received the programmed version scored significantly higher than those who saw the conventional television. Upon further analysis, this difference was found largely due to the results in the high-ability group. In the lesson on nuclear reactions, the programmed presentation resulted in higher scores than the conventional presentation on five out of six comparison, including two reaching a significant level.

In a subsequent experiment by the same authors (Gropper and Lumsdaine, 1961b), a television lecture on movies was sequenced like a teaching machine program, and compared with the conventional version of the same television lecture. Students who received the programmed lecture and made active responses scored significantly higher than those who received the conventional television lecture.

Schrag and Holland (1965) tested the effectiveness of combining programmed instruction with film to teach college physics. A teaching machine was hooked up with a projector so that at 18 points within the program, the student used the projector to present the relevant demonstration from a film. The demonstrations took up 20 minutes of the film's 45-minute running time. Fifteen college students underwent this treatment, while six viewed the film in its entirety. A test covered all essential points in the original film and its sound track. Out of a possible total score of 10, the median score was 9.5 for the subjects using the combined teaching machine and film program, and 6.5 for the subjects viewing the film only. The finding indicates that the combination program was highly effective.

These experimental results suggest that the use of programmed instruction along with television or film presentation will increase learning because of the active responses by the students, which can then be reinforced. This means that other media can, in certain circumstances, share one of the pedagogical advantages of programmed instruction.

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This is, of course, far from a complete comparison of instructional media. However, in a sense these findings are reassuring because they indicate that pupils can learn from any of the media, and the choice therefore can be made on the basis of cost, technological base, the particular problem to be solved, and the pedagogical assistance most needed.

As an illustration of how one well-informed student of audio-visual instruction, the editor of the Audio-Visual Communication Review, views the factors that go into the choice among media, we invite your attention to these two tables (Allen, 1967):

Instructional Media Stimulus Relationships to Learning Objectives.

INSTRUCTIONAL MEDIA TYPE:	Learning Factual Information	Learning Visual Identifications	Learning Principles, Concepts and Rules	Learning Procedures	Performing Skilled Perceptual-Motor Acts	Developing Desirable Attitudes, Opinions & Motivations
Still Pictures	Medium	HIGH	Medium	Medium	low	low
Motion Pictures	Medium	HIGH	HIGH	HIGH	Medium	Medium
Television	Medium	Medium	HIGH	Medium	low	Medium
3-D Objects	low	HIGH	low	low	low	low
Audio Recordings	Medium	low	low	Medium	low	Medium
Programmed Instruction	Medium	Medium	Medium	HIGH	low	Medium
Demonstration	low	Medium	low	HIGH	Medium	Medium
Printed Textbooks	Medium	low	Medium	Medium	low	Medium
Oral Presentation	Medium	low	Medium	Medium	low	Medium

Equipment/Media Relationships and Considerations.

Instrument	Media Used	Materials Production Considerations	Availability of Facilities and Equipment	Equipment Cost
1. Filmstrip or slide projector	35mm filmstrips or 2x2 slides	Inexpensive. May be done locally in short time.	Usually available. Requires darkended room.	low
2. Overhead transparency projector	Still pictures and graphic representations	Very inexpensive. May be done locally in short time.	Available. May be projected in light room.	low
3. Wall charts or posters	Still pictures	Very inexpensive. May be done locally in very short time.	Available. No special equipment needed.	very low
4. Motion pictures (projection to groups)	16mm motion picuture (sound or silent)	Specially-produced. Sound film is costly and requires 6-12 months time.	Usually available. Requires darkened classroom.	moderate
5. Motion picture projection as repetitive loops (8mm silent) to individuals	8mm motion picture film (silent)	Special production normally necessary. May be produced as 16mm film alone or locally at low cost and in short time.	Not normally available. Will need to be specially procured to meet requirement of instructional program.	low per unit, but moderate for groups
6. Magnetic tape recorder	¼" magnetic tape	Easy and inexpensive. Usually produced locally.	Available	low
7. Record player	33⅓, 45 or 78 rpm disk recordings	Need special recording facilities. Usually commercially made.	Usually available	low
8. Display area	3-D models	May vary in complexity and in difficulty of production. Component parts easy to obtain.	Available	varies from low to high
9. Television (closed-circuit)	Live presentations. Motion picture film. Videotape recordings. Still pictures.	Normally requires large and skilled production staff.	Not normally available	moderate to high
10. Teaching machines & programed textbooks	Programed material	Some programs available commercially. But will normally be specially prepared for course.	Not normally available	low per unit, but moderate for groups
11. System combinations	Television. Motion pictures. Still pictures. Audio recordings.	Complex. Probably will be done locally to meet specific requirements.	Not normally available	moderate to high

VII. A Note in Conclusion

In summing up, we must return to the caveats with which we began this review. We have used a wide-angle, relatively low-definition lens. This review has covered considerably more literature than any previous one in this field – but not so much as will be available when the new ERIC clearinghouse completes its computerized index. We have known about more studies than we have been able to get our hands on, and in a number of cases have had to work from abstracts rather than the entire research report. Because of time limitations and the intended nature of this book, we have not given detailed study to certain areas where the results are puzzling and contradictory; such detailed study and reinterpretation, perhaps reconceptualization, will be required before research can clear up the uncertainties. In other words, this is an exploratory, rather than a definitive step in the process of understanding what research tells us about instructional television – a survey of findings, from which certain useful guidelines can be derived, and on the basis of which some of the priorities for further study can be decided upon.

In a sense, instructional television is more complex than the research that deals with it. Complex behavior has baffled learning theorists for years. A number of variables are clearly at work in determining what a given individual learns from television. In many cases these variables interact, and the total must be a great deal more complex than can be represented by the one-variable experiments that typically make up the research literature, no matter how clean and skillful they are.

A good experiment of this kind that varies one characteristic against one or two others is highly useful, but its results must always be stated *other things being equal.* As we know from bitter experience, other things are *not* always equal. The full complexity of the process has to be approached by *interlocking* experiments, as attitude change research has gone forward under the example of Carl Hovland and the Yale studies, rather than by single experiments which themselves comprehend the complex situation. The user must keep in mind, when he applies research findings of the kind represented in this book, the disparity between the relative simplicity of the laboratory situation and the complexity of the ordinary classroom. That is to say, he must consider as fully as he can the situation in which the finding is to be applied. Is there anything in his situation that might change the result as determined in the experiment? Is there anything that might call for him to examine other experiments dealing with other variables that may be important in his own situation?

Assuming a degree of caution in applying results, what kind of guidelines can we extract from this body of research?

For one thing, it has become clear that there is no longer any reason to raise the question whether instructional television can serve as an efficient tool of learning. This is not to say that it always *does*. But the evidence is now overwhelming that it *can,* and, under favorable circumstances, does. This evidence now comes from many countries, from studies of all age levels from preschool to adults, and from a great variety of subject matter and learning objectives. The questions worth asking are no longer whether students learn from it, but rather, (1) does the situation call for it? and (2) how, in the given situation, can it be used effectively?

The question of whether the situation calls for instructional television is one that has to be answered in terms of needs, availabilities, and alternatives. It goes without saying that most television has been introduced into instruction without full consideration of these matters. The typical request for advice begins with an explanation that television has become available, or could be made available, and the question usually is how can we use it? Of course, this already forecloses many of the possibilities. When a request begins with a problem, rather than with technology – that is, a school system has such and such a problem, and what technology, if any, would help to solve it? – then there is a great deal more freedom to consider alternatives and applications.

In that case, the first step is to define the need as sharply as possible. Exactly what has to be done, in what sequence, and over what time and area? What financial resources could be applied to it? Is it the kind of problem that needs to be solved by adding teachers or in-service training for teachers, or by sharing a few expert teachers more widely? Is it the kind of problem that requires supplementary experiences for the students, or a different order and level of basic learning experience? Is it the kind of problem that would benefit from technology at all? (For example, are the time requirements such that technology is not needed to speed the process of teacher training, or the supplementary needs such that the desired experiences could be brought into the classroom only by media channels of some kind?)

The case studies, perhaps more than the experiments, help us to appraise the kind of situations in which the media are likely to be useful. The question is, which one of them or which combination of them is most appropriate to the need and the capability. For example, if the problem is to raise the level of language skills, then perhaps language laboratories are indicated, if they can be afforded. If the problem is to learn a set of manual skills, perhaps films are indicated, if they are available, and if the school system can afford them and deliver them. If the goal is to increase the opportunity for individual rates of progress, perhaps programmed instruction is called for – if suitable programs are available, and, before long, computers to manage this sort of instruction.

Economics and technical capabilities enter into all these decisions. Radio is cheaper than television, and can contribute a great deal to learning, if a concurrent and moving picture is not required. Over a relatively small area and small number of classrooms, it will probably be cheaper to deliver sight and sound by films than by television; and teachers have the great advantage of being able to schedule films when they wish, to stop them for discussion or review, or to repeat them at will. On the other hand, it becomes a major problem to have films available and deliver them on call over a large area and to many schools; and for such coverage, television will probably have lower unit costs, as well as the advantage of being live and being changeable more easily in response to feedback from the classroom and to curricular alterations. In general, schools have tended to use television more often for direct teaching, films for supplementary experiences; but there is no reason why a film should not be delivered by television; and, given the videotaping capabilities that we shall have before too many years, it will become possible for a classroom teacher to use a television program like a film. On the other hand, there is no reason why an exceptional teaching series should not be recorded on film and used for direct teaching, where films seem to be preferable.

The alternatives and combinations, therefore, are many. One restriction upon them, particularly in developing countries, is the availability of technical support and skills. For example, it is hard to introduce any of these media without electricity being widely available, but is obviously much harder to use television in that case than to use radio. It is almost impossible to introduce any of the more sophisticated media unless technical personnel are available, for operation and maintenance. Therefore, any decision to use one of the instructional media must take into consideration the kinds and numbers of persons who must be trained. As we have pointed out, training is not only for engineers, technicians, and maintenance men; teachers, also, need help and guidance in using a media system.

These considerations will at least suggest the kinds of questions that must be asked in deciding whether and what media. Much of the material in the preceding pages will illuminate these questions, and detailed reading of the case studies and experience records will help still more. But it is not a simple decision. The most encouraging finding of the research literature is that students apparently can learn from any of these media. Therefore, if one or more of the media can be selected as most likely to meet the need and fit the capabilities, then a school system can proceed in some confidence that it can learn how to use it or them effectively.

What does the research literature say about how television can be used effectively for instruction? In the large, the findings are predictable. Instructional television works best when it is made an integral part of instruction – that is, when it is woven into a classroom context of learning activities; indeed, when the studio and classroom teachers function as nearly as possible as a teaching team. It seems to work best when it is applied to a problem of sufficient size to justify its use and encourage teachers to join in wholeheartedly, and administrators and financial controllers to give it the support it needs; and when it is used in sufficient size to bring down the unit costs, and to make its impact visible. It works best when it is planned and introduced carefully as part of a teaching-learning system rather than a branch grafted on to what is already there.

Beyond those larger considerations, the research seems to suggest that effective use of television grows out of attention to the basic requirements of good teaching, rather than to any fanciness that might be peculiar to television. The qualities that emerge from the research described in Chapter III – puzzling and contradictory though some of those findings are – are qualities like simplicity, good organization, motivation, practice, knowledge of results, rest pauses at appropriate points, cues that direct the pupil to the essential things he is to learn, and so forth. The Denver television project concluded that a skillful classroom teacher was the best learning aid that could be combined with television, and the importance of the classroom teacher serving as a full ally of the television teaching is underlined in other studies. There are very real doubts that color contributes in most cases to learning from television, or that dramatic production is any more effective than lectures or discussions, or even that animation contributes to learning except in situations where it clearly calls attention to the items to be learned. But the basics always seem to work, in television teaching as in other teaching.

What, then, are the peculiar advantages of instructional television? It can share a good teacher with a very large number of classes, rather than one. It can introduce a variety and quality of visual and auditory experiences and demonstrations that would be impossible for most individual classrooms to equal, but are quite feasible for a central programming service. It can carry teaching where there are no schools – for example, to remote areas or to students who are home-bound. It is an effective device for in-service training of teachers. And, because one teaching performance serves many classrooms, it frees time that can be used in a number of salutary ways: to prepare better demonstrations and better expositions; to vary the form of classroom instruction with visitors, interviews, panels, actualities, and the like; to give classroom teachers an opportunity, if the system is well managed, to spend more time with small learning groups and individual guidance.

The chief disadvantages are easy to see, also. It is essentially a one-way medium. The reader of this book will be interested in some of the experiments described in the preceding pages which deal with call-back or talk-back systems, intended to capture some of the advantages of two-way communication for televised teaching. But the fact remains that it is not a good device for class discussion or for giving quick answers to questions from students. All the more reason, therefore, to build it into a context where the classroom teacher or monitor will encourage active discussion, direct questions and answers, after the television lesson is completed; or, if it does not reach into school, to combine it with correspondence study or paper writing or telephone or radio communication, as is done in countries like Australia and Japan.

A second disadvantage is the difficulty of doing what we have just suggested – building television into the ongoing activities of a classroom, fitting the same material to the needs of different classes at the same time, creating an efficient team-teaching situation where the teachers may be miles apart. And because this is difficult, and sometimes threatening and aggravating to classroom teachers, we have a history of resistance to instructional television.

Perhaps we must accept this resistance as a fact of life with ITV. As we have said in preceding chapters, it is not hard to understand why there should be such resistance, and especially why it should occur in the early days of a teaching medium. Yet, the results described in this volume are not discouraging. Attitudes toward ITV are not invariably unfavorable. Indeed, in studies like the one made in Hagerstown after eight years of television, they are really rather remarkably favorable, on the part of teachers, administrators, parents, and students alike. It is a good guess that student attitudes toward instructional television would compare, on the average, quite favorably with their attitudes toward other instruction. And as the principle of division and specialization of labor progresses through the teaching profession, we can expect less initial hostility from teachers.

The information we have about attitudes toward instructional television encourages us to believe that it need not be perceived as boring or threatening. How it is used makes the difference. Teaching on television can be as interesting or as uninteresting as most classroom teaching; and we ought to know enough now about the qualities of good teaching, and have enough experience with bringing resources to bear on preparing good television classes, to reduce the proportion of uninteresting teaching to a minimum. Whether the teacher feels threatened will be determined in large measure by the way television is introduced, the extent of involvement by the classroom teacher, the quality of the televised classes and the support given them. These two results will interact, for the content of the television and the way it is combined with classroom activities will affect both teacher and student attitudes, and the teacher's attitude toward it will affect the student's also.

An interesting suggestion arises from juxtaposing some of the results described in Chapter III with some of those in Chapter IV. There seems to be little reason to believe, for example, that color television usually makes much contribution to learning. The same might be said of animation, dramatic presentation, and certain other production devices. On the other hand, there is reason to think that, in some circumstances at least, students may like color better than black and white, they may enjoy animation, they may appreciate the change of pace to dramatic presentation, and so forth. It may be necessary, with the television teacher deprived of instant feedback from her audience and with the audience deprived of the opportunity to ask a question or interrupt the exposition, to do a little extra in order to maintain interest, even though the extra things may not themselves contribute directly to learning. Similarly, it may be necessary to go to special efforts in order to keep the class active and responding during the television lesson.

And there is good reason to ask whether television should not adopt as a standard practice, wherever possible, the pretesting and revising of televised lessons. One of the chief residues of the last ten years of activity with programmed instruction is a mountain of evidence that more effective learning experiences can be developed by testing materials on students, revising, testing again, and so on. Chapter III describes some impressive experiments in which television programs were also tested and revised, and when they were used the revised version taught considerably more than the previous one. A procedure like this may have to become standard practice as a substitute for the swift feedback and the intimate knowledge of a class that the classroom teacher has and the television teacher does not have. Such a procedure might contribute immensely to the effectiveness of instructional television and to its acceptance.

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ABSTRACT

52 PROPOSITIONS IN 6 AREAS CONCERNING THE CONDITIONS OF EFFECTIVE LEARNING FROM TELEVISION ARE DEVELOPED FROM A SURVEY OF THE RESEARCH LITERATURE--(1) HOW MUCH PUPILS LEARN FROM INSTRUCTIONAL TELEVISION, (2) EFFICIENT USE OF THE MEDIUM IN A SCHOOL SYSTEM, (3) TREATMENT, SITUATION, AND PUPIL VARIABLES, (4) ATTITUDES TOWARD INSTRUCTIONAL TELEVISION, (5) TELEVISION IN DEVELOPING REGIONS, (6) LEARNING FROM TELEVISION COMPARED WITH LEARNING FROM OTHER MEDIA. EVIDENCE FOR EACH PROPOSITION IS BRIEFLY SUMMARIZED. LITERATURE SEARCH DEPENDED PARTLY ON ABSTRACTS, PARTLY ON COMPLETE DOCUMENTS, AND INCLUDED FOREIGN AS WELL AS U.S. RESEARCH. IT IS CONCLUDED FROM OVERWHELMING EVIDENCE THAT TELEVISION CAN BE AN EFFICIENT TOOL OF LEARNING AND TEACHING. WHEN IT IS NOT EFFICIENT, THE REASON IS USUALLY IN THE WAY IT IS USED. EVIDENCE FAVORS THE INTEGRATION OF TELEVISION INTO OTHER INSTRUCTION, SIMPLICITY RATHER THAN "FANCINESS", EMPHASIS ON THE BASIC REQUIREMENTS OF GOOD TEACHING, INTRODUCTION OF THE MEDIUM SO AS TO MINIMIZE RESISTANCE, AND TESTING AND REVISION OF PROGRAMS. WHETHER THE TELEVISION MEDIUM IS TO BE PREFERRED, AND WHETHER IT IS FEASIBLE FOR DEVELOPING REGIONS, DEPENDS ON OBJECTIVES AND CONDITIONS. A SELECTED BIBLIOGRAPHY OF 303 TITLES IS INCLUDED.